

# An investigation on *Mycetinis* (Euagarics, Basidiomycota)

Ronald H. Petersen<sup>1</sup>, Karen W. Hughes<sup>1</sup>

<sup>1</sup> Ecology & Evolutionary Biology, University of Tennessee, Knoxville, TN37996-1100 USA

Corresponding author: Ronald H. Petersen (repete@utk.edu)

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## Abstract

Molecular analyses have revealed a clade which equates with the genus name *Mycetinis* Earle. An overall survey of this genus, however, has not been forthcoming. The current study summarizes taxa which are placed in *Mycetinis* based on morphological and/or molecular data. Fifteen taxa are accepted: *Mycetinis scorodonius* f. *diminutivus* and *Mycetinis yunnanensis* are proposed as new, while *Mycetinis cinnamomeus*, *Mycetinis olidus*, *Mycetinis prasiosmus*, *Mycetinis subalpinus* and *Mycetinis virgultorum* are newly recombined binomials. Phylogenies based on molecular data show overall disposition in Omphalotaceae, *Gymnopus* and allied genera, and taxa of *Mycetinis*.

## Key words

Molecular phylogenies, biogeography, morphological taxonomy

## Introduction

In preparing a proposal of a small, new genus of Antipodal marasmoid taxa, a comprehensive molecular phylogeny indicated that the proposed group was concladic with *Mycetinis* (Wilson and Desjardin 2005). With this relationship evident, it seemed efficacious to further examine *Mycetinis*. In assembling information about *Mycetinis*, all known taxa were investigated, descriptions were revised and microstructures were illustrated. It is this synopsis that constitutes this paper. It falls short of a monograph because “specimens examined” is not exhaustive and as a rule, type specimens have not been inspected (although previous type specimen studies have been cited).

*Marasmius alliaceus* was used by F.S. Earle (1909) as the type species of his *Mycetinis*, based on a European group identified by Schroeter (1889). Kühner "1935" (1936) proposed *Marasmius* sect. *Alliacei*, typified by the same binomial, overlooking the opportunity to recombine Earle's genus name.

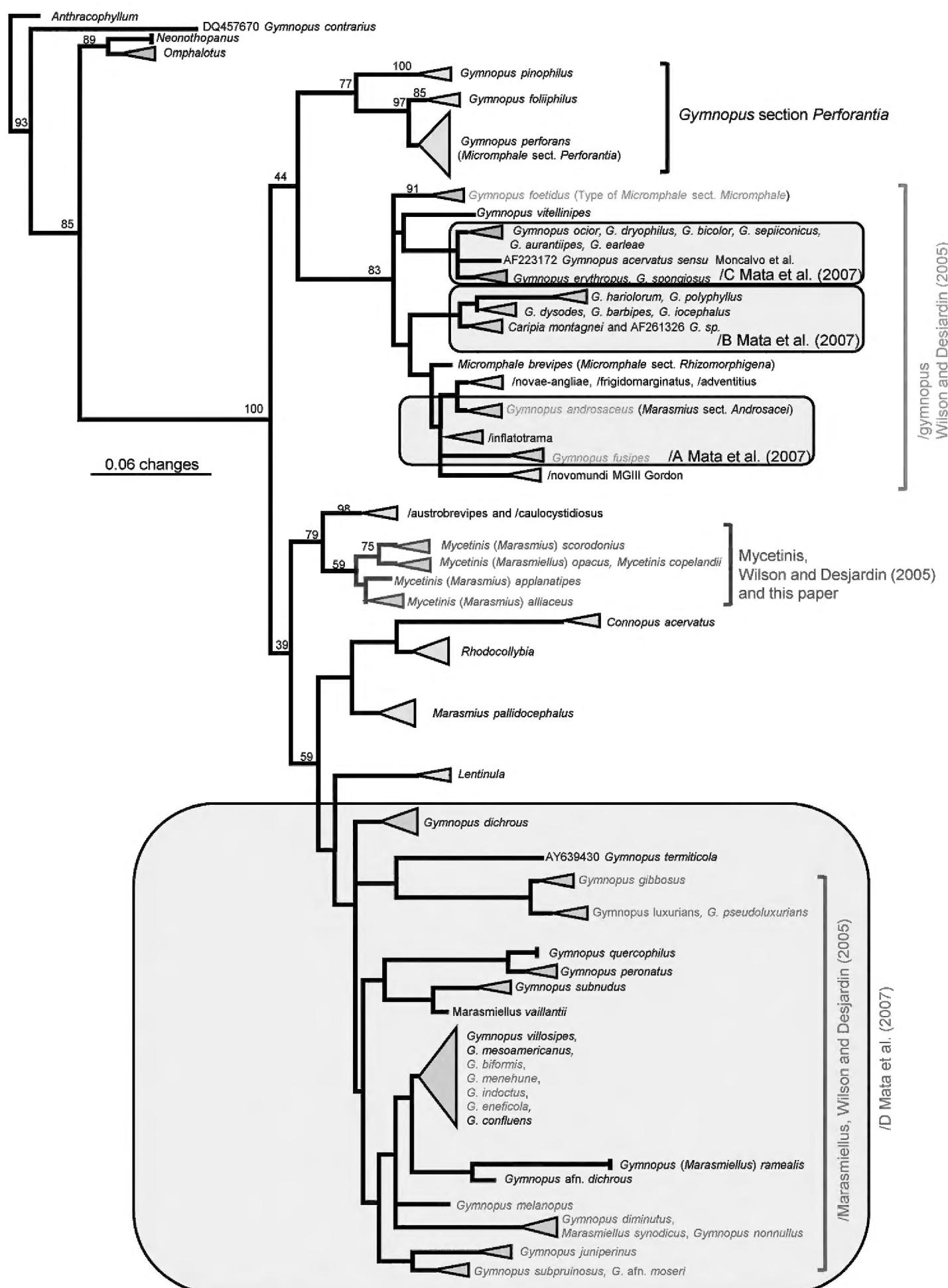
Resurrection of Earle's (1909) genus name has been obviated by molecular studies in traditional *Marasmius* and *Gymnopus*. Concurrent with the concept that DNA sequences might be used as a taxonomic tool, Owings (1997) and Owings and Desjardin (1997) presented evidence that traditional *Marasmius* was not monophyletic. Over time, no fewer than 28 "morpho-genera" had been segregated from *Marasmius*. Phylogenies based on LSU sequences indicated a relationship between *M. scorodonius* and *M. copelandii*, and sometimes included *Ma. opacus* in a common clade.

Moncalvo et al. (2002), based on LSU sequences, also identified a small clade comprising *Ma. opacus* and *M. scorodonius*. Mata et al. (2004) identified the same clade in a paper not intended for this purpose. Wilson and Desjardin (2005), also based on LSU sequences, again resolved this clade, but found that additional taxa, *M. alliaceus*, *M. copelandii* and *M. applanatipes* were closely related. They referred to this clade as *Mycetinis*, mined from Earle's early use. They also discussed this genus and transferred names as appropriate. Mata et al. (2007) again recovered this clade based on ITS sequences, but lacked ITS sequences for *M. applanatipes* and *M. copelandii*. Sister to this clade was *Ma. candidus*. Noordeloos and Antonin (2008) made additional nomenclatural transfers to *Mycetinis* based on morphological similarities and, notably, the pervading odor of garlic of basidiomata of most taxa.

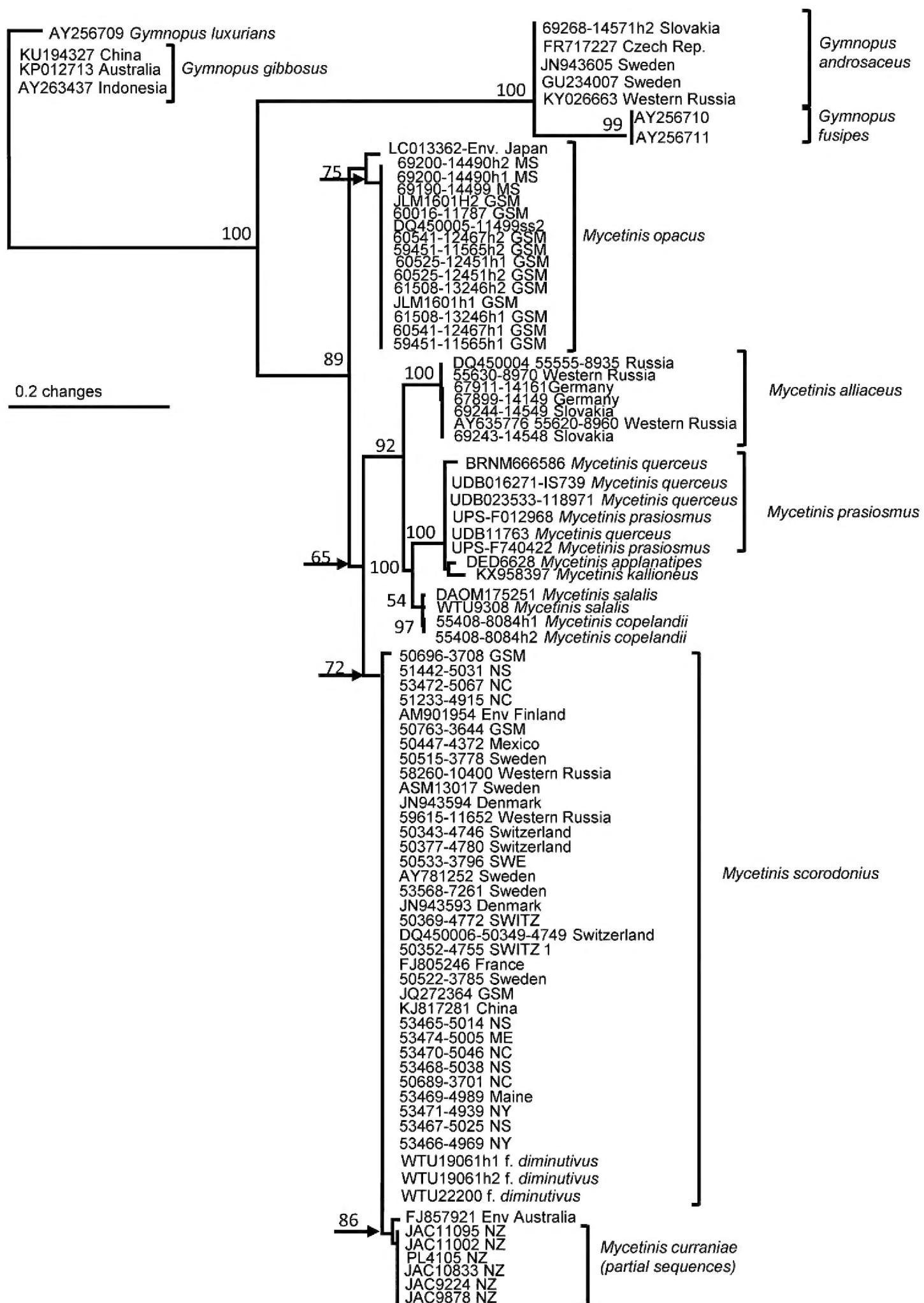
## Materials and methods

Procedures for extraction of DNA, PCR, and DNA sequencing were described in Aldrovandi et al. (2015). Sequence alignments were performed in GCG (2000). PhyML analyses were performed in Geneious 8.1.8 Geneious (2015) using 100 bootstrap replicates. Sequences for putative *Mycetinis querceus* were obtained from the UNITE database (Abarenkov et al. 2010). A sequence for *Mycetinis kallioneus* was received from Ellen Larsson (KX958397). *Mycetinis curraniae* partial ITS sequences were obtained from Dr. Jerry Cooper, Landcare, New Zealand. DNA sequences are available from GenBank (numbers KY696725–KY696789). Aligned sequence files are available from the Dryad data repository (aligned *Gymnopus* LSU sequences and tree file are available doi: 10.5061/dryad.4081h; *Mycetinis* ITS-based sequence alignments and tree files are available at doi: 10.5061/dryad.nq8nd). A list of sequences used for Fig. 1 is given in Petersen and Hughes (2017). A list of sequences used for Figs 2 and 77 and their GenBank numbers is given in Appendix 2. Sequences are not available for all taxa in this study although extraction was attempted in most cases. Problems with old specimens included degraded DNA and secondary contamination with other fungi.

Abbreviations: M. = *Marasmius*; Ma. = *Marasmiellus*; Mi. = *Micromphale*; My. = *Mycetinis*. KWH, RHP = authors. BF = bright field microscopy; PhC = phase contrast



**Figure 1.** PhyML analysis of 191 nrLSU sequences within the Omphalotaceae using 100 bootstrap replicates (See also Petersen and Hughes, 2016). Clades were collapsed to better show broad relationships. Species names in blue represent /marasmiellus (Wilson and Desjardin, 2005). Species names in red represent /gymnopus (Wilson and Desjardin, 2005). The major clades reported in Mata et al. (2007) are overlaid in blue. *Mycetinis* is in green.



**Figure 2.** PhyML analysis of *Mycetinis* showing its relationship to *Gymnoporus* species.

microscopy. IKI = Melzer's reagent. TFB = Tennessee field-book number, assigned to fresh collections in order to track specimen, photos, notes, etc.; TENN-F = Fungus Herbarium, University of Tennessee. GSMNP = Great Smoky Mountains National Park, Tennessee/North Carolina. Photographs of microstructures are in Phase Contrast microscopy, using a Q-color Olympus camera apparatus. Some other terms are defined under taxonomic characters.

In citing color, the following methods have been followed: 1) colors cited without any special editorial markings are/were subjective by the observer; 2) colors enclosed in quotation marks (i.e. "Rood's brown") are from Ridgway (1912); 3) colors cited alphanumerically (i.e. 6D8) are from Kornerup and Wanscher (1967); and 4) other color manuals mentioned by author (i.e. Munsell, Cailleux, Maertz & Paul) are left to the reader to trace.

## Results

### Phylogenetic relationships

Phylogenetic placement of *Mycetinis* with respect to *Gymnopus* s.s. and some related *Marasmiellus* species based on ribosomal LSU sequences only is given in Fig. 1 [modified from Petersen and Hughes (2016)]. In this phylogeny, *Mycetinis* forms a moderately-supported monophyletic clade that is sister to an undescribed clade of two Australian taxa (79% bootstrap value). *Mycetinis scorodonius* and "*Marasmiellus*" *opacus* are sister taxa in this analysis. An ITS-based phylogenetic analysis is given in Fig. 2. In this analysis, *Mycetinis* is monophyletic as are clades representing *Mycetinis alliaceus*, *My. querceus/prasiomus*, *My. salalis/copelandii*, *My. opacus*, *My. scorodonius* and *M. curraniae*. *My. curraniae* appears as a clade within *M. scorodonius* but ITS sequences are quite distinct and the association may be influenced by truncated sequences representing *My. curraniae*.

## Taxonomy

### Taxonomic characters

**Basidiomata:** In no instance can basidiomata of *Mycetinis* be regarded as large or fleshy as compared with those of, for example, *Russula*, *Chlorophyllum* or *Amanita*. Stipes are usually less than 80 mm long, and no more than 3–4 mm broad, often less than 1 mm. Very generally, basidiomata seem to sort trimodally. 1. *Mycetinis alliaceus*, *My. opacus*, *My. prasiomus* and *My. scorodonius* exhibit larger, more substantial basidiomata, comparable to *Marasmius* taxa or taxa of *Gymnopus* sect. *Vestipedes* (including stipe vesture). 2. *Mycetinis cinnamomeus*, *My. curraniae*, *My. olidus*, *My. subalpinus*, *My. scorodonius* f. *diminutivus*, *M. virgultorum* and *M. yunnanensis* exhibit diminutive fruitbodies, mac-

romorphologically comparable to those of many taxa or *Marasmiellus*. 3. *Mycetinis applanatipes*, *M. copelandii*, *M. kallioneus*, *M. salalis* seem to form basidiomata intermediate in size, but in all cases, stipes are robust for the size of the basidiome. These can be compared to basidiomata of *Gymnopus* sect. *Androsacei* and sect. *Perforantia*.

Reference to odor of garlic is remarkably consistent in literature dealing with more commonly recognized taxa (i.e. *My. scorodonius*, *My. alliaceus*, etc.). For less popularized taxa, especially those represented by preserved specimens, odor is simply not mentioned. Whether absent or dismissed cannot be known until additional fresh collections are made. The characteristic odor may be emitted by whole fresh basidiomata, crushed structures, especially lamellae, sometimes even dried and preserved material (but not specimens treated with insecticides). A similar garlic taste also is widespread.

**Pileus:** *Size*: Just as basidiomata can be sorted by size and stature, so pileus size can be sorted commensurately. Thus, taxa with short, slender stipes also form small pilei (*My. cinnamomeus*, *My. curraniae*, *My. olidus*, *My. subalpinus*, *My. scorodonius* f. *diminutivus*, *My. virgultorum*, *My. yunnanensis*); longer, stouter stipes are accompanied by pileus of wider dimensions (*My. alliaceus*, *My. opacus*, *My. prasiosmus* and *My. scorodonius*). Basidiomata of remaining taxa are small but robust (*My. appланatipes*, *My. copelandii*, *My. kallioneus*, *My. salalis*).

*Shape*: All pilei are strongly convex to globose when very young, but soon expand through strongly convex to shallowly convex, plane, or even somewhat everted in age. In some taxa, a shallow, broad umbo is occasionally seen, especially when young (*My. subalpinus*, *My. prasiosmus*, *My. kallioneus*).

*Hygrophany*: Hygrophanous quality is only mentioned occasionally, but pilei of some taxa seem to exhibit a weak hygrophanous reaction at least over the disc and/or inner limb.

*Margin shape*: In all taxa, pileus margin is inturned through development and becomes plane only in maturity. Tissue is consistently thin. One character seems ubiquitous across the genus: In mature or aged pilei, pileus margin becomes shallowly sulcate-striate, perhaps as a function of *in situ* drying. Pileus margin is consistently paler in color than disc, often reported as off-white or cream colored.

*Surface*: Pilei are never visibly scaly or warted but always smooth and usually suede-like (not glabrous). Occasional reports of a delicate, radial rugulose surface have been made, but this quality disappears upon drying.

*Color*: Although blended into brownish shades, there is a common occurrence of burnt reddish or ferruginous colors, at least on pileus disc, and while limb and margin soon become paler, the pileus disc seems to retain these reddish, reddish tan, rusty, reddish brown or cinnamon shades. Generally speaking, the smaller pilei are paler in color, often described as white, off-white or pale cream color, but usually with the disc retaining some richer coloration.

**Lamellae:** *Spacing*: In taxa with diminutive basidiomata (*My. cinnamomeus*, *My. curraniae*, *My. olidus*, *My. subalpinus*, *My. scorodonius* f. *diminutivus*, *My. virgultorum* and *My. yunnanensis*), total lamellae (lamellae plus lamellulae) usually number 20–30, while in larger basidiomata (*My. alliaceus*, *My. prasiosmus*, *My. scorodonius*), total lamel-

lae number 50-100 (or more), but, as is typical, through lamellae (those extending from pileus margin to stipe) are far less numerous, 5-12 in diminutive basidiomata, 18-35 in moderate-sized basidiomata. An anachronism seems to be *My. opacus* which exhibits moderately size basidiomata but distant and reduced lamellae.

**Thickness and ventricosity:** It appears that moderately sized basidiomata exhibit thin lamellae, perhaps correlated with high lamellar number and crowded spacing. Both diminutive and intermediate basidiomata form thicker lamellae with extensive lamellar tramae. Photos of basidiomata in nature clearly shows the frequent ventricose shape of lamellae, pronounced in everted individuals. Examination of many specimens shows that dried lamellae assume a distinctive wavy (crisped) disposition, even in moderately sized basidiomata.

**Attachment:** In intermediate-sized and especially diminutive basidiomata, lamellae, usually reported as adnate or adnexed, seem consistently attached to a pseudocolarium firmly or weakly clasping the stipe apex. This phenomenon is best seen in dried basidiomata where lamellae have seceded from their juxtaposition to stipe apex. The pseudocolarium is not generally demonstrable in the moderately sized basidiomata.

**Stipe: Robustness:** In moderately-sized and diminutive basidiomata, stipes are slender as compared with length, and basidiomata gracile. In intermediate-size basidiomata (*My. applanatipes*, *My. copelandii*, *My. kallioneus*, *My. salalis*), stipes are stouter as compared to length. Interestingly, except for boreal *My. kallioneus*, the other intermediate-sized taxa are all distributed in the northwestern rain forest of North America. This may be related to temperate temperatures and seasonally plentiful rainfall. Photos of moderately (*My. alliaceus*, *My. scorodonius*) and some diminutive sized (*My. subalpinus*) basidiomata show a terete, equal, rigidly erect stipe. Stipes of intermediate sized basidiomata are similarly erect, but usually more robust and often compressed (*My. applanatipes*, *My. copelandii*, *My. kallioneus*, *My. salalis*). Stipes of diminutive sized basidiomata (*My. curraniae*, *My. cinnamomeus*, *My. olidus*, *My. scorodonius* f. *diminutivus*, *My. virgultorum*, *My. yunnanensis*) are capillary and often curved, similar to the situation in diminutive *Marasmiellus* basidioma.

**Insertion:** Insititious insertion is reported only for *My. opacus* (but most often with sparse basal pad) and *My. virgultorum* (Antonín 1995). Otherwise, stipes inserted on leafy or woody substrates have a mycelial pad at base, while stipes of numerous taxa disappear into humus substrate in mycelial tangles (*My. alliaceus*, *My. scorodonius*, *My. kallioneus*, *My. prasiosmus*).

**Vesture:** Only *My. scorodonius* and diminutive *My. cinnamomeus* have been described as without stipe vesture. This is easily demonstrable in the former, and in Desjardin's notes on authentic material of *My. cinnamomeus* there is repeated "caulocystidia absent." Otherwise, vesture ranges from delicately pruinose to rather shaggy, especially downward on stipe.

**Color:** Unique in the genus is the black (or darkest brown-black) stipe in *My. alliaceus*. In most other taxa, upper stipe is pale, often concolorous with lamellae, becoming darker downward, often in cinnamon to rusty shades.

**Fruiting habitat:** There seems to be no evidence of mycorrhizal association; all taxa seem demonstrably saprophytic. *Mycetinis applanatipes* utilizes mixed conifer duff.

*My. copelandii* fruits on sclerophyllous leaves (*Quercus*, *Lithocarpus*, etc.); unidentified (*My. yunnanensis*); *My. olidus* fruits on needles of *Pinus* and midribs of *Quercus*; *My. prasiosmus* fruits on decaying deciduous leaves of *Quercus*, *Fagus*, and *Betula*; *My. scorodonius* fruits on *Fagus*, *Alnus*, etc.; *My. virgultorum* fruits on canes of *Rubus* (also detritus of *Quercus*, etc.,); *My. alliaceus* on wood (*Fagus*, etc.); *My. scorodonius* fruits on buried wood and bark; *My. curraniae* fruits on *Leptospermum* s. l., *Metrosideros*; *My. cinnamomeus* on *Eucalyptus* and *My. virgultorum* on *Quercus* etc. *My. curraniae* and *My. cinnamomeus* are also found on bark of living, standing trees. Two taxa (*My. subalpinus*, *My. opacus*) seem associated with *Rhododendron* although on two different continents, while a third (*My. salalis*) fruits on leaves of *Gaultheria*, another member of Ericaceae.

**Distribution:** Assumedly worldwide: western North America (*My. appalantipes*, *My. copelandii*, *My. salalis*, *My. scorodonius* f. *diminutivus*), eastern North America (*My. olidus*, *My. opacus*, *My. scorodonius*); Europe (*My. alliaceus*, *My. prasiosmus*, *My. scorodonius*, *My. subalpinus*), boreal Scandinavia (*My. kallioneus*) trans-Mediterranean (*My. virgultorum*), Antipodes (*My. curraniae*, *My. cinnamomeus*), southwestern China (*My. yunnanensis*). Candidates for inclusion in *Mycetinis* from Africa remain unidentified.

**Micromorphology:** *Pileipellis*: Prior to the introduction of molecular phylogenetics, pileipellis structure could have been the most diagnostic character by which marasmoid and collybioid mushroom could be judged to resemble *My. alliaceus*, the type species of *Mycetinis*. Instead, such taxa were placed in *Marasmius* sect. *Alliacei* (primarily on strong odor of garlic) and *Marasmius* sect. *Chordales* (based on unique pileipellis). Once molecular analyses demonstrated a clade binding such organisms together, the neglected genus name, *Mycetinis*, was resurrected.

*Pileipellis* in this group always includes inflated hyphal termini in a roughly hymeniform layer, reminiscent of this tissue in Physalacriaceae (i.e. *Oudemansiella*, *Flammulina*, etc.). These inflated elements vary from subglobose to broadly clavate or lobate, may be firm- or thick-walled, may be pigmented or hyaline, and range from entire (*My. alliaceus*, *My. prasiosmus*) or apically produce flaccid digitate or subcoralloid diverticula (*My. curraniae*, *My. scorodonius*). In addition to these inflated elements can appear diverticulately branched terminal hyphae reminiscent of *siccus*-type broom cell-like pileocystidia ranging from rudimentary (*My. appalatipes*, *My. curraniae*), well-developed (*My. opacus*, *My. salalis*, *My. subalpinus*, *My. scorodonius* and f. *diminutivus*, *My. virgultorum*, *My. yunnanensis*). Occasionally, free-form hyphal segments reminiscent of cells of the *textura intricata* of a *dryophila*-structure are found (*My. copelandii*, *My. olidus*).

*Pileal hairs* are probably ubiquitous and have been demonstrated in most species.

*Pleurocystidia* seem similar throughout *Gymnopus*, much of traditional *Marasmius* and some segregant genera. In the present study, two problems can be identified: 1) taxa in which pleurocystidia are either absent or more probably undifferentiated from hyphal termini (*My. kallioneus*, *My. copelandii*, *My. appalatipes*); and 2) taxa for which pleurocystidia are reported as absent, but are illustrated as basidioles [*My. virgultorum* (Eyssartier & Moreau, 1995: figs 5–2), *My. subalpinus* (Moreau 2007: figs 1, 2)]. Differentiated pleurocystidia are found in *My. yunnanensis* (with content partition), *My.*

*scorodonius*, *My. salalis*, *My. prasiosmus*, *My. opacus* (submammilate), *My. olidus*, *My. curraniae* and *My. alliaceus*; pleurocystidia are unknown in *My. cinnamomeus*.

**Basidia:** Of hymenial elements, basidioles are usually most common and can be distinguished by rounded apex and clavate to narrowly clavate shape (versus pleurocystidia, with narrowing and acute apex). Basidia are usually plentiful in squash mounts of lamellae and are often characterized by a narrowly clavate to almost cylindrical shape and subrefrangent, heterogeneous contents appearing oily. Often, post-partal basidia do not collapse, remaining as empty “husks.” Sterigmata may be fewer than normal (1, 2-sterigmate), but 4-sterigmate basidia dominate. An exception is *My. kallioneus*, with exclusively 2-sterigmate basidia, but presence of clamp connections nonetheless.

**Basidiospores:** Spores of most taxa fall within a limited range of dimensions, about  $7-11 \times 3.5-4.5 \mu\text{m}$  ( $L^m = 7.5-11 \mu\text{m}$ ). The smallest spores are produced by *My. yunnanensis*. Two taxa, *My. salalis* and *My. olidus*, produce significantly longer spores of marasmoid shape (tapering proximally). A summary of spore statistics, arranged from smallest spores to longest is:

*My. yunnanensis*:  $6-7.5(-8.5) \times 3-4(-4.5) \mu\text{m}$  ( $Q = 1.67-2.33$ ;  $Q^m = 1.95$ ;  $L^m = 6.9 \mu\text{m}$ ),

*My. curraniae*:  $(6.5)-7-8(-10) \times 4-4.5(-5) \mu\text{m}$  ( $Q = 1.50-2.00$ ;  $Q^m = 1.76$ ;  $L^m = 7.4 \mu\text{m}$ ),

*My. virgultorum*:  $7-8 \times 3.6-4.3 \mu\text{m}$  (teste Eyssartier & Moreau 2001)

*My. applanatipes*:  $(7.5)-8.7-10.2(-12) \times 4.8-6(-6.6) \mu\text{m}$ ,  $\mu\text{m}$  ( $Q = 1.18-1.92$ ;  $Q^m = 1.57$ ;  $L^m = 9.2 \mu\text{m}$ ),

*My. cinnamomeus*:  $7.2-10.2 (-12) \times 3.4-5.1(-6.2) \mu\text{m}$  [ $Q^m = 2.0$ ;  $L^m = 8.4 \mu\text{m}$ ] (teste Desjardin, pers. comm.)

*My. opacus*:  $(6.5)-7.5-10(-11) \times (2.8-)3.5-4.5(-5) \mu\text{m}$  ( $Q = 1.50-2.43$ ;  $Q^m = 1.98$ ;  $L^m = 8.23 \mu\text{m}$ ),

*My. scorodonius*:  $(6.5)-8.0-10.0(-11.0) \times (3.5-)4-4.5(-5.5) \mu\text{m}$  ( $Q = 1.55-2.57$ ;  $Q^m = 1.93$ ;  $L^m = 9.0 \mu\text{m}$ ),

*My. prasiosmus*:  $(7-)9-10.5(-12.5) \times (3.5-)4-5.5(-6) \mu\text{m}$  ( $Q = 1.63-2.25$ ;  $Q^m = 1.97$ ;  $L^m = 9.2 \mu\text{m}$ )

*My. alliaceus*:  $(7.5-)9.5-11.5 \times (4.5-)5.5-6(-9) \mu\text{m}$  ( $Q = 1.06-2.20$ ;  $Q^m = 1.51$ ;  $L^m = 9.86 \mu\text{m}$ ),

*My. subalpinus*:  $(9.0)9.5-11.8(12) \times 5.0-6.2 \mu\text{m}$  [ $Q = (1.60)1.75-2.03(2.20)$ ] (teste Moreau 2007)

*My. copelandii*:  $(9-)10.5-12(-17) \times 3-4(4.5) \mu\text{m}$  ( $Q = 2.63-3.83$ ;  $Q^m = 3.29$ ;  $L^m = 11.75 \mu\text{m}$ ),

*My. olidus*:  $(8-)11-16 \times (2.8-)3.5-4(-4.5) \mu\text{m}$  ( $Q = 2.00-3.67$ ;  $Q^m = 2.93$ ;  $L^m = 11.7 \mu\text{m}$ ),

*My. salalis*:  $(15-)16-18.5(-19) \times (3.5-)4-5 \mu\text{m}$  ( $Q = 3.00-4.75$ ;  $Q^m = 3.83$ ;  $L^m = 16.8 \mu\text{m}$ ),

**Cheilocystidia:** apparently absent in *My. prasiosmus*, otherwise ranging from simple clavate without diverticula (*My. alliaceus*, *My. applanatipes*) to variously complex: *My. cinnamomeus*, *My. copelandii*, *M. scorodonius* f. *diminutivus*, clavate with apical outgrowths; *My. curraniae* inflated with diverticula; *My. kallioneus* broadly clavate with lobes; *My. olidus* broadly clavate, sometimes with lobes; *My. opacus* diverticulate; *My. salalis* diverticulate; *My. scorodonius* ventricose with diverticula; *My. subalpinus*

clavate, with or without diverticula; *My. virgultorum* diverticulate; *My. yunnanensis* catenulate-lobate.

**Caulocystidia:** Caulocystidia are reported as absent for *My. cinnamomeus*, *My. scorodonius* and its f. *diminutivus*, but as present in all other taxa. Individually, caulocystidia range from tortuous to straight and setoid, and from arrangement as a lawn or turf to synnematoid, the latter especially toward the stipe base.

**Clamp connections:** Present and common in all taxa; most easily demonstrated on lamellar and pileus tramal hyphae, but obvious also on hymenial elements (basidioles, basidia, pleurocystidia). Stipe medullary hyphae bear clamp connections but these are less conspicuous due to hyphal crowding in which septa are obvious but clamp connections are not so.

### *Mycetinis* nomenclator

***Mycetinis*** Earle., 1909. Bull. N. Y. Bot. Gard. 5: 414.

**Basionym:** *Marasmius* § *Mycinopsis* Schroeter. 1889. Krypto. Fl. Schles. 3': 558.  
Earle: "This includes *Marasmius* § *Mycena*, subsection *Chordales*, of the Sylloge."  
= *Marasmius* sect. *Alliacei* Kühner. 1933. Botaniste 25: 87. (as "*Alliatiae*")

**Type species.** *Marasmius alliaceus* (Jacq.) Fr. 1838. Epicrisis 383.

**Mycetinis description.** **Basidiomata** marasmelloid, marasmoid or collybioid, either diminutive or moderately sized, reviving or not. **Pileus** 3–15 or 20–50 mm broad, at first strongly convex becoming campanulate to convex to applanate with decurved margin, off-white to pigmented in brownish, reddish brown to yellowish brown with disc always somewhat darker than limb or margin, smooth or suede-like, sometimes weakly hygrophanous; pileus margin entire to shallowly sulcate-striate; trama thin to fairly thick. Pileus trama pliant. **Lamellae** ridge-like to well-developed, thin or thick, distant to moderately crowded, free, adnexed to adnate, often attached to a thin, weak pseudocollarium best demonstrated in dried basidiomata. **Stipe** 8–60 mm long, central, insititious to not so, usually with distinct basal mycelium, hollow or lightly stuffed but not solid, glabrous, pubescent or furfuraceous, paler upward, downward dull greyish tan to reddish brown or dark brown or nearly black. **Odor** negligible or (usually) very distinct, like onion or garlic.

**Habitat and distribution.** Saprophytic on decaying deciduous leaves, buried rotting wood, bark (including bark of living, standing trees) and in one species on mixed conifer detritus; distribution in Europe (*My. alliaceus*, *My. scorodonius*, *My. kallioneus*, *My. prasiosmus*, *My. subalpinus*), trans-Mediterranean (*My. virgultorum*) western and eastern North America (*My. applanatipes*, *My. olidus*, *My. salalis*, *My. scorodonius* and f. *diminutivus*), Asia (*My. yunnanensis*) and Antipodes (*My. curraniae*, *My. cinnamomeus*).

**Pileipellis** a hymeniform layer of inflated hyphal termini sometimes with scattered broom cell-like pileocystidia especially at pileus margin; elements clamped, stalked,

subglobose, obpyriform, deeply lobed, occasionally strongly pigmented, firm-to thick-walled, rarely with a few knobs or finger-like apical projections. **Pleurocystidia** present, from poorly differentiated to narrowly or broadly fusiform; contents homogeneous, sometimes vaguely partitioned. **Basidia** clavate, sometimes subcapitulate, (2-)4-sterigmate, often long, clamped; contents heterogeneous, appearing oily (PhC). **Basidiospores** either narrowly clavate ( $Q^m = >3$ ), or ellipsoid to broadly ellipsoid ( $Q^m = <2.5$ ), marasmoid, subamygdaliform or broadly ellipsoid. **Cheilocystidia** present, from undifferentiated from basidioles, cylindrical, clavate, subampulliform, lageniform, sometimes arbuscular with digitate outgrowths. **Caulocystidia** present or absent, often gathered into floccose clusters or synnematoid projections. **Rhizomorphs** unreported; telepods very rarely present on extra-European taxa only.

### *Mycetinis* taxonomic outline:

1. *Mycetinis alliaceus* (Jacq.: Fr.) Earle. 1909. Bull. N.Y. Bot. Gard. 5: 414.
2. *Mycetinis applanatipes* (Desjardin) A.W. Wilson & Desjardin. 2005. Mycologia 97: 677.
3. *Mycetinis cinnamomeus* (Cleland) R.H. Petersen & Desjardin. (below)
4. *Mycetinis copelandii* (Desjardin) A.W. Wilson & Desjardin. 2005. Mycologia 97: 677.
5. *Mycetinis curraniae* (G. Stev.) J. A. Cooper & P. Leonard. 2012. Index Fungorum 3: no. 550026.
6. *Mycetinis kallioneus* (Huhtinen) Antonin & Noordel. 2008. Czech Mycol. 60: 26.
7. *Mycetinis olidus* (Gilliam) R.H. Petersen (below)
8. *Mycetinis opacus* (Berk. & M.A. Curtis) A.W. Wilson & Desjardin. 2005. Mycologia 97: 677.
9. *Mycetinis prasiosmus* (Fr.: Fr.) R.H. Petersen (below)  
= *Mycetinis querceus* (Britzelm.) ss. Antonin & Noordel. 2008. Czech Mycol. 60: 26.
10. *Mycetinis salalis* (Desjardin) Redhead. 2012. Index Fungorum 8: 1.
11. *Mycetinis scorodonius* (Fr.: Fr.) A.W. Wilson & Desjardin. 2005. Mycologia 97: 678.
- 11A. *Mycetinis scorodonius* f. *diminutivus* R.H. Petersen, K. Dyson & J. Ammirati (below)
12. *Mycetinis subalpinus* (P.-A. Moreau) P.-A. Moreau & R.H. Petersen (below)
13. *Mycetinis virgultorum* (Malençon & Bertault) R.H. Petersen (below)
14. *Mycetinis yunnanensis* R.H. Petersen (below)

### Key to species of *Mycetinis*

- |   |  |   |
|---|--|---|
| 1 | Stipe glabrous; caulocystidia absent.....  | <b>2</b>  |
| - | Stipe vested, pruinose or silky above, often becoming minutely hispid downward.....          | <b>4</b>  |
| 2 | Basidiomata of moderate size; fruiting chiefly on buried wood; Europe and North America..... | <b>11. <i>My. scorodonius</i></b>                       |
| - | Basidiomata diminutive; fruiting on bark or soil.....  | <b>3</b>  |
| 3 | South Australia; fruiting on bark of living <i>Eucalyptus</i> ...                            | <b>3. <i>My. cinnamomeus</i></b>                        |
| - | Western Washington state; fruiting on soil in urban environments .....                       |   |
|   |  | <b>11. <i>My. scorodonius</i> f. <i>diminutivus</i></b> |

- 4 Spores 12–20 µm long, marasmoid (tapered proximally, clavate to curved-clavate); North America ..... 5
- Spores 7–12 µm long, ovate to amygdaliform ..... 7
- 5 Spores 14–20 µm long; on dead leaves of *Gaultheria shallon*; North American northwest ..... 10. *My. salalis*
- Spores 12–16.5 µm long; North America ..... 6
- 6 Pileus 7–16 mm broad; stipe 1–3 mm broad; west coast of North America ..  
..... 4. *My. copelandii*
- Pileus 3–8 mm broad; stipe 0.5–1 mm broad; on dead deciduous leaves; eastern North America ..... 7. *My. olidus*
- 7 Asia, Antipodes; basidiomata diminutive ..... 8
- Europe, Africa, North America ..... 9
- 8 New Zealand; on rotting wood; stipe curved; spores 7–8 × 4–4.5 µm; pileipellis structures usually thick-walled, appendaged ..... 5. *My. curraniae*
- Southwestern China (Yunnan); on decaying deciduous leaves; stipe curved; spores 6–7.5 × 3–4 µm; pileipellis structures a mixture of inflated and arbuscular structures ..... 15. *My. yunnanensis*
- 9 West Coast of North America; spores 8.5–10.5 × 4.8–6 µm; cheilocystidia poorly differentiated, thin-walled; fruiting on conifer needles .....  
..... 2. *My. appplanatipes*
- Europe, Arctic or boreal ..... 10
- 10 Arctic; basidia 2-spored (but clamp connections present); spores 10–12 × 7–8 µm ..... 6. *My. kallioneus*
- Europe, Africa; basidia 4-spored ..... 11
- 11 North Africa, southern Europe; basidiomata diminutive (pileus 3–8 mm broad; stipe 8–17 × 0.5–1 mm); pileus disc dull brown, limb and margin paler ..... 14. *My. virgultorum*
- Europe, Scandinavia ..... 12
- 12 Spores width 3.5–5.5 µm (length 8–10.5 µm); fruiting on dead deciduous leaves (i.e. *Quercus* or *Fagus*); stipe pallid upward, downward reddish brown; Europe ..... 9. *My. prasiosmus*
- Spores width 5–7.5 µm (length 9–12 µm) ..... 13
- 13 Basidiomata of moderate size; fruiting on debris and wood (often buried) of *Fagus*; stipe blackish brown downward; Europe ..... 1. *My. alliaceus*
- Basidiomata diminutive; fruiting on twigs and leaves of *Rhododendron*; stipe dull reddish, paler upward; mountains of central Europe ..... 12. *My. subalpinus*

### 1. *Mycetinis alliaceus* (Jacq.: Fr.) Earle. 1909. Bull. N.Y. Bot. Gard. 5: 414.

Basionym: *Agaricus alliaceus* Jacquin. 1762. Enum. Stirp. Vindobonensis: 299.

≡ *Agaricus alliaceus* Jacq.: Fr. 1821. Syst. Mycol. 1: 140.

≡ *Marasmius alliaceus* (Jacq.: Fr.) Fr. 1838. Epicr. 383.

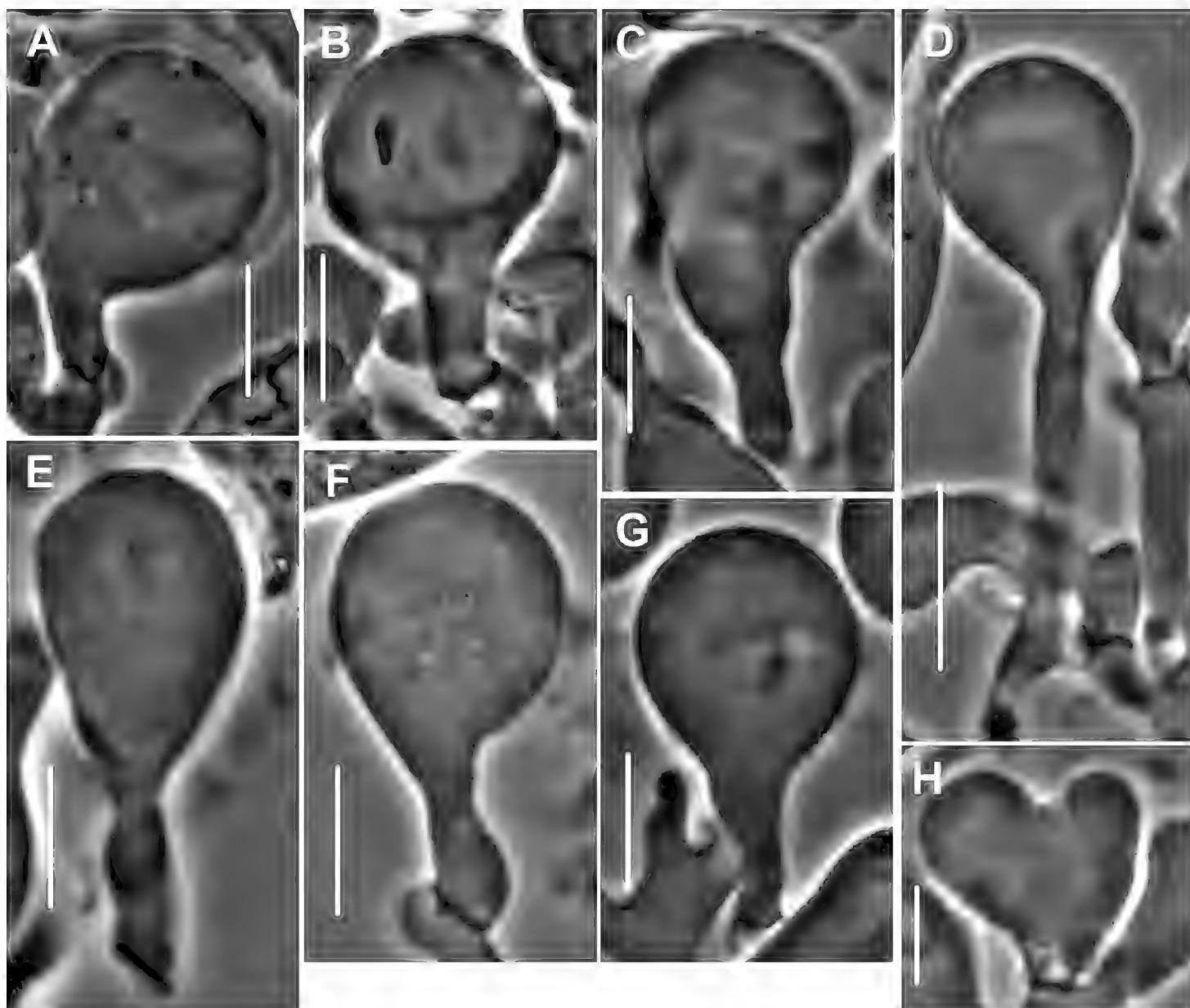


**Figure 3.** *Mycetinis alliaceus*. Habit photo. Standard bar = 10 mm. Courtesy Pilzgalerie.

**Type specimen** (neotype, design. Antonin and Noordeloos 1993: Austria, Steiermark, Wildalpen [N47°39'52", E14°59'11"], Lurghöhe, 12.VII.1981, J. Schreurs 578 (L)

**Diagnosis.** 1) Basidiomata of moderate size (pileus ~40 mm broad; stipe 40–85 × 3–5 mm); 2) cheilocystidia short-stalked, digitate to cigar-shaped; 3) stipe brown-black, lightly vestured upward, often pruinose basally; 4) basidia with heterogeneous (multiguttulate) contents; 5) pileipellis elements subglobose to obpyriform, firm-walled; 6) stipe often pseudorhizal, usually associated with *Fagus sylvatica*; 7) dried basidiomata retaining garlic taste; 8) basidiospores broadly ovate to amygdaliform, firm-walled; 9) spore contents heterogeneous, with 1–several inclusions.

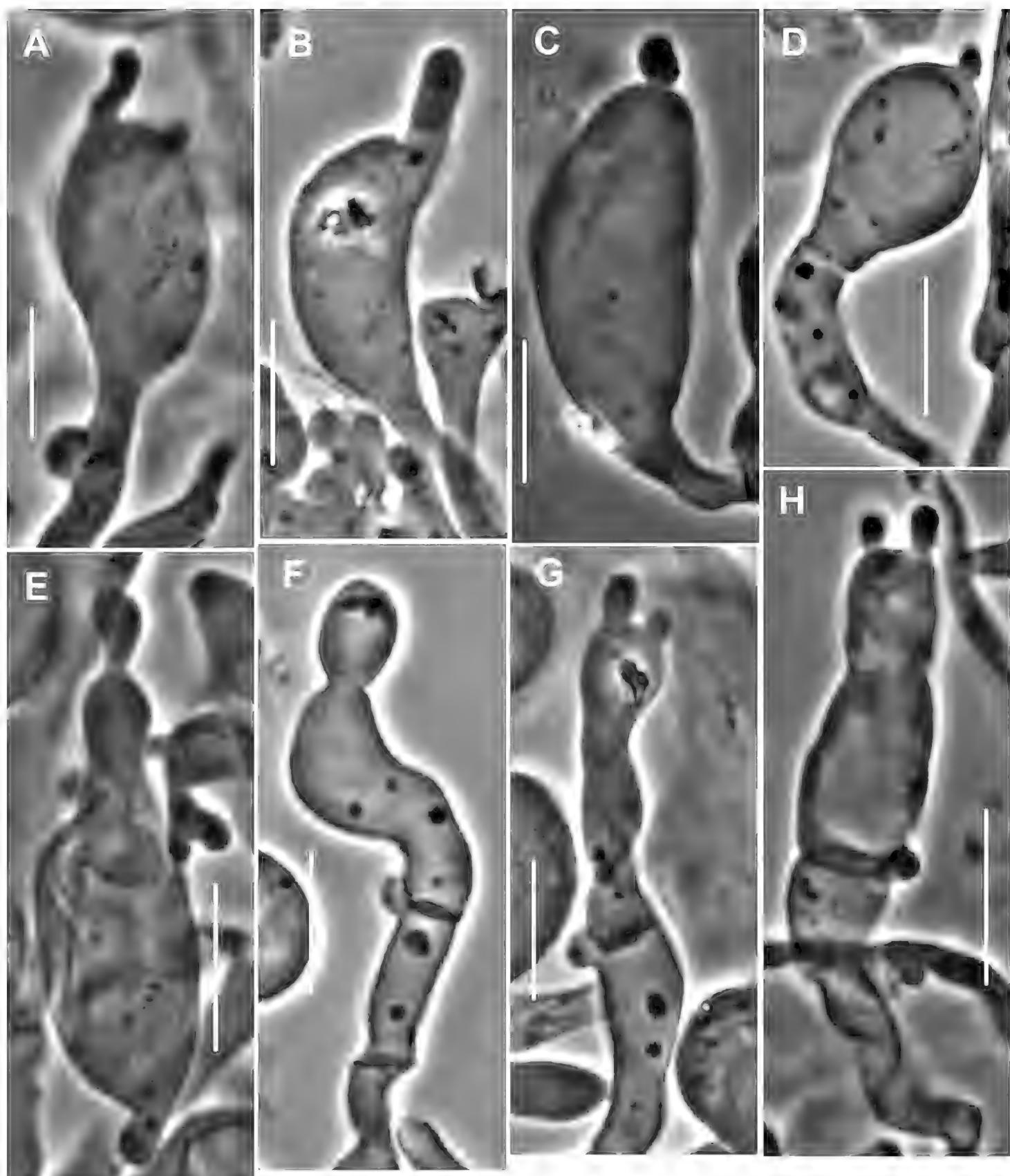
**Description. Basidiomata** (Fig. 3) of moderate size. **Pileus** 5–45 mm broad, conical when young becoming truncate-conical to more or less plane with downturned margin, usually deeply sulcate-striate almost to disc, smooth (matt, not glabrous), wrinkled (radially and circumferential) when dried, more or less unicolorous, light brown 6D4-6 (near “sayal brown” 6C3 to “tawny olive” 5C5), often with violaceous



**Figure 4.** *Mycetinis alliaceus*. Pileipellis elements. Standard bars = 10 µm. TFB 11451 (TENN-F-59312).

tint (“tilleul buff” 7B2 to “vinaceous buff” 9B2), reluctantly bruising in spots to “sorghum brown” 8D5; margin delicately scalloped, sometimes abruptly off-white. **Lamellae** adnate to adnexed, close to crowded, thin, -2 mm broad, entire (not serrulate), total lamellae 75–135, through lamellae 18-24, white to slightly yellowish 5A-B2 to (dried) “ochraceous buff” 5A5, “light vinaceous fawn” 10B2, bruising to “livid brown” 10D4 or “russet” 7D6; lamellulae in 3-4 ranks. **Stipe** 40–85 × 3–5 mm, erect, terete or somewhat compressed, especially apically, straight, not insititious, upward often brown 6E4-7 to deep maroon (“Hay’s russet” 8D7, “Kaiser brown” 7E8), downward darkest brown “clove brown” 6F3, “bone brown” 7F8 to “aniline black” 12F3, lightly vested above, more heavily so near base (and there with mouse gray to “old gold” 3C6 vesture); base occasionally appearing short-pseudorhizal, disappearing in humus, perhaps reaching buried wood, soil often composed of insect castings. **Rhizomorphs** apparently within substrate (not extrinsically visible), -24 × 0.8–1 mm diam, now copper-brown, curly, occasionally branched; branches usually small, peg-like. **Odor** strong of garlic; **taste** distinct of garlic, sometimes also acrid.

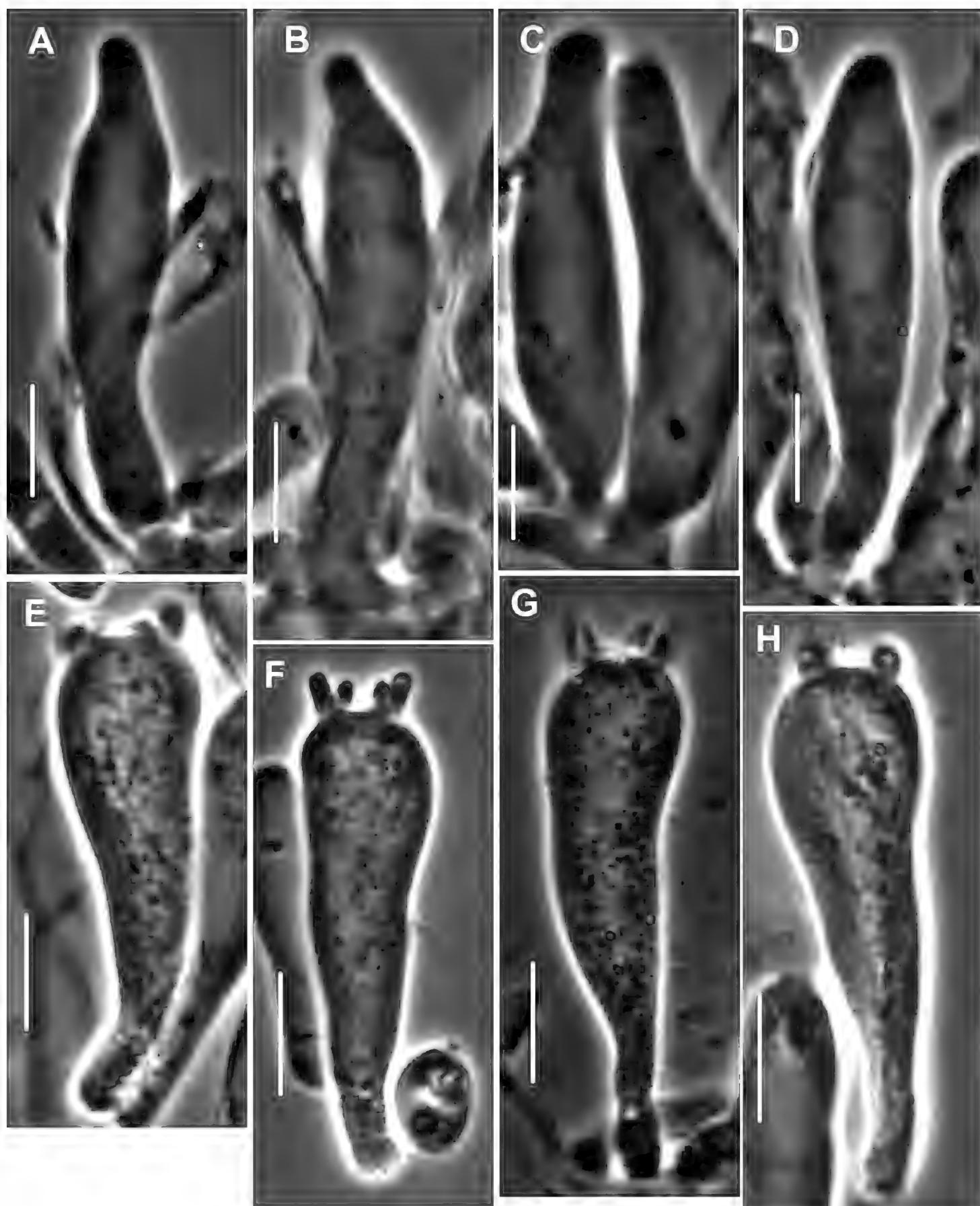
**Habitat and phenology.** Antonin & Noordeloos (2010) describe ecology as “Gregarious on decaying stems and twigs of *Fagus sylvestris*, rarely also on the leaves, also



**Figure 5.** *Mycetinis alliaceus*. Abnormal pilepellis elements from pileus margin. Standard bars = 10  $\mu\text{m}$ . TFB 11451 (TENN-F-59312)

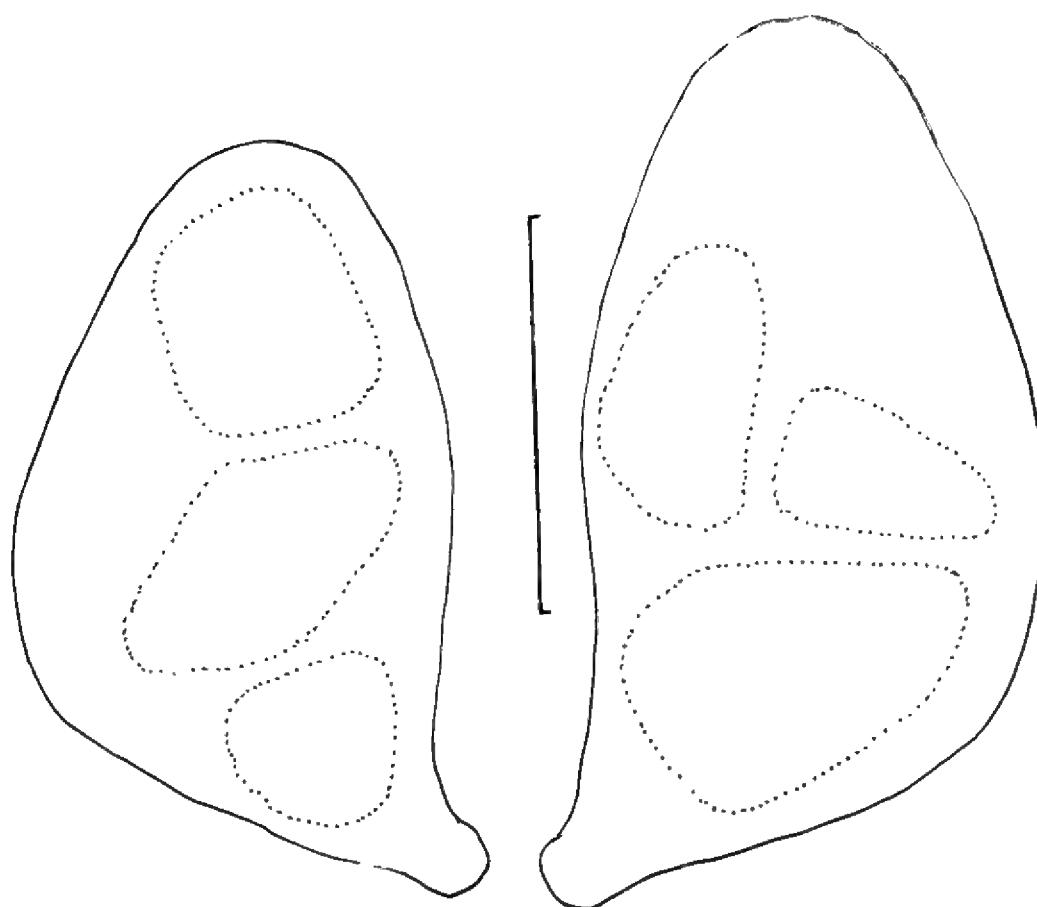
recorded from *Carpinus* ... and coniferous needles ..." It can be concluded that the preferred substrate is woody. Known from most of the European *Fagus* distributional area; Russian Caucasus, western Russia, continental Europe, British Isles and Scandinavia; to this time, appearing absent from North America. Late summer, autumn.

**Pileipellis** a more or less hymeniform layer of inflated cells (Figs 4, 5) not apparently involved in a slime matrix; cells 30–45(-60)  $\times$  12–23  $\mu\text{m}$  (at widest point), stalked (stalk 7–40  $\times$  4–6  $\mu\text{m}$ ), conspicuously clamped, firm-walled; inflated portion



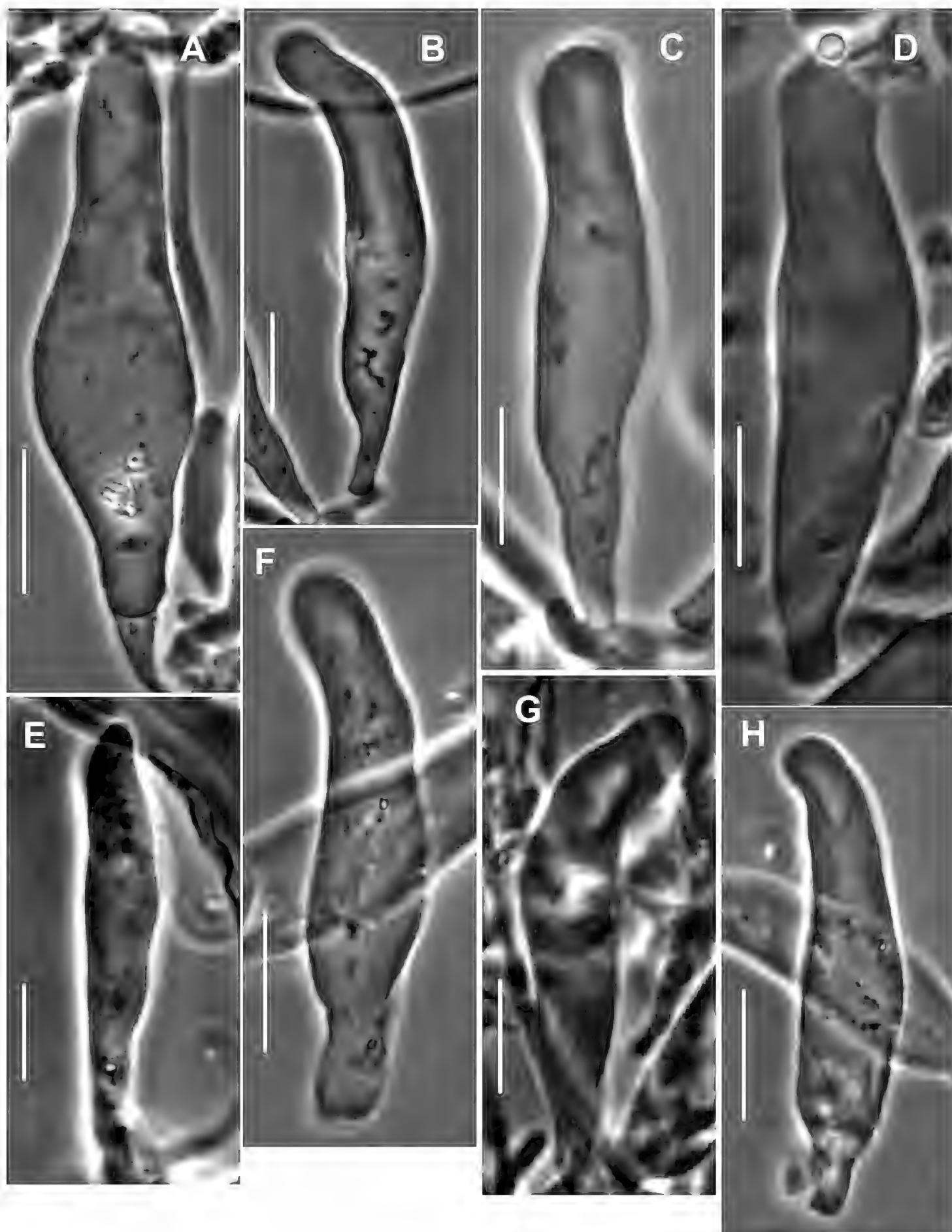
**Figure 6.** *Mycetinis alliaceus*. **A–D** Pleurocystidia. Note homogeneous contents. **E–H** Basidia. Note heterogeneous contents. Standard bars = 10  $\mu\text{m}$ . TFB 11451 (TENN-F-59312).

obpyriform to subglobose, firm-walled, hyaline, smooth to minutely roughened, occasionally misshapen, especially at pileus margin, and/or with apical diverticula ranging from short lobes to subcoralloid structures; contents homogeneous. **Pileocystidia** apparently absent. Pileus tramal hyphae filamentous, 4–8  $\mu\text{m}$  diam, firm-walled, loosely interwoven, conspicuously clamped, not involved in a slime matrix or gelatinized



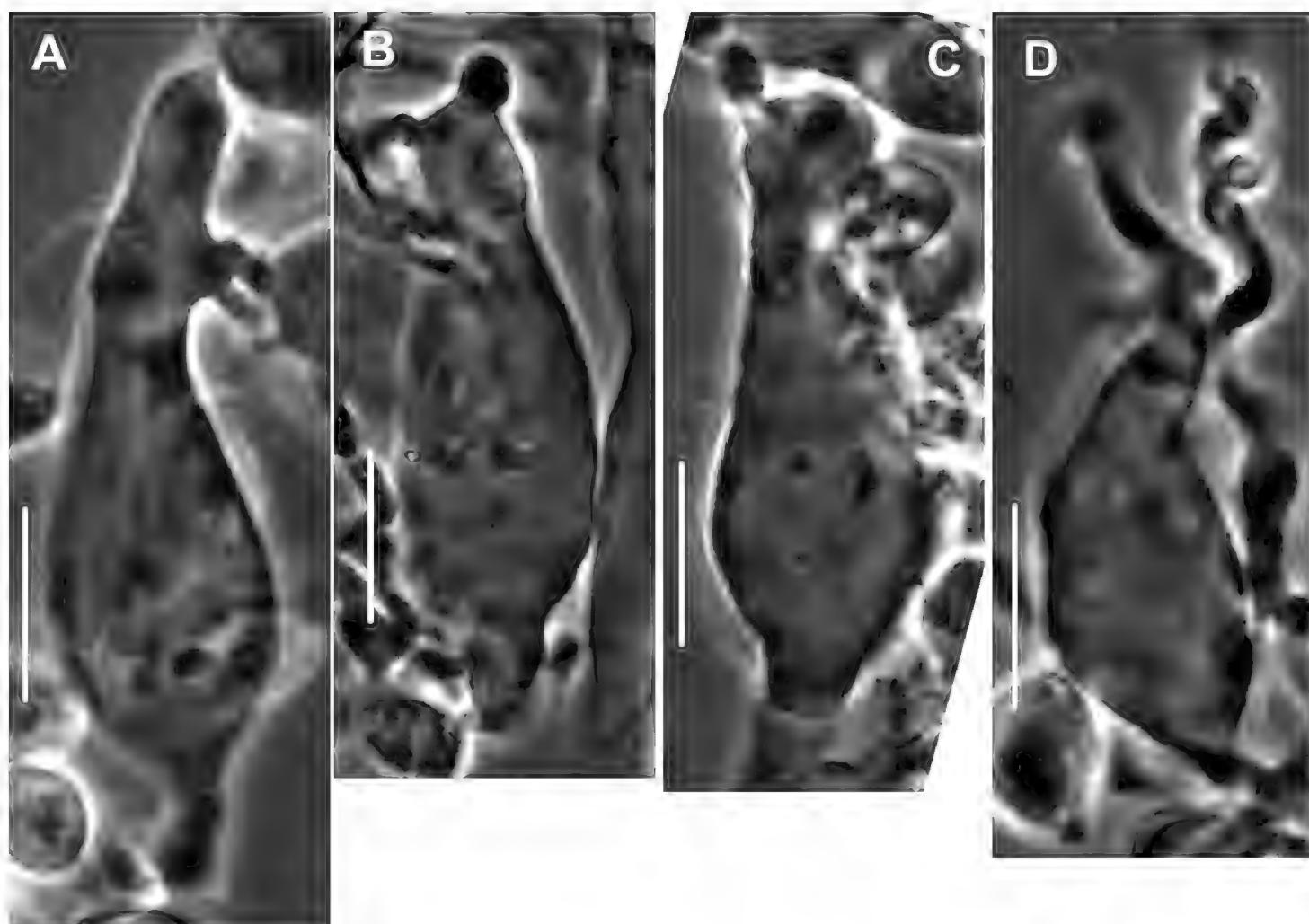
**Figure 7.** *Mycetinis alliaceus*. Basidiospores. Standard bar = 5 µm. TFB 11451 (TENN-F-59312).

walls. Lamellar trama loosely interwoven; hyphae 4–25 µm diam, firm-walled, conspicuously clamped, hyaline. **Pleurocystidia** (Fig. 6A–D) 36–44 × 9–12 µm, fusiform, usually with submammilate apex, thin-walled, conspicuously clamped; contents homogeneous. **Basidioles** (Fig. 6E–H) clavate; basidia 39–43(-54) × 10–14 µm, clavate, 4-sterigmate, clamped; contents granular to granulo-guttulate. **Basidiospores** (Fig. 7) (7.5-)9.5–11.5 × (4.5-)5.5–6(-9) µm ( $Q = 1.06\text{--}2.20$ ;  $Q^m = 1.51$ ;  $L^m = 9.86$  µm), subglobose, ovate to subtly amygdaliform, firm-walled, hyaline, inamyloid; contents heterogeneous with dark inclusions (PhC); spores copious on lamellar surface; empty spores not collapsing. **Cheilocystidia** (Figs 8, 9) 45–72 × 7–20 µm (at widest point), stalked (stalk 6–12 × 3–5 µm, obscurely clamped), cylindrical, cigar-shaped, occasionally fusiform or sublageniform, bluntly rounded apically, sometimes producing lobate or digitate outgrowths (perhaps when revived in nature or confined), firm-walled, hyaline; contents homogeneous. **Stipe medullary hyphae** strictly parallel, 4–7.5 µm diam, thin-walled, hyaline, without slime matrix, obscurely clamped. **Stipe cortical hyphae** coherent but without discernable slime, 4–8 µm diam, thick-walled (wall ~1.0 µm thick), obscurely clamped, pigmented yellow-brown, producing caulocystidia as side branches or hyphal termini. **Caulocystidia** (Fig. 10) **from upper stipe** scattered, 10–75 × 7–11 µm, digitate, cylindrical, often with constrictions, arising as side branches of stipe surface hyphae or as surface hyphal termini, arranged perpendicular to stipe surface or repent against it, thick-walled (wall ~1.5 µm thick), hyaline, smooth. **Caulocystidia from stipe base** identical, thickly gregarious, 10–110 × 7–13 µm, perpendicular to stipe surface as a turf.



**Figure 8.** *Mycetinis alliaceus*. Cheilocystidia. Standard bars = 10  $\mu\text{m}$ . TFB 11451. (TENN-F-59312).

**Commentary.** Antonin and Noordeloos (2010): “Lamellae distant, L = 14–24 (27), l = 1–3, free or narrowly adnexed with decurrent tooth, sometimes attached to a pseudocollarium, rather broad, whitish or grayish, often with brown-red stains when old, with entire or pruinose, sometimes serrulate, concolorous or slightly darker edge.”



**Figure 9.** *Mycetinis alliaceus*. Cheilocystidia, showing adventitious apical outgrowths. Standard bars = 10  $\mu\text{m}$ . TFB 4737 (TENN-F-50334).

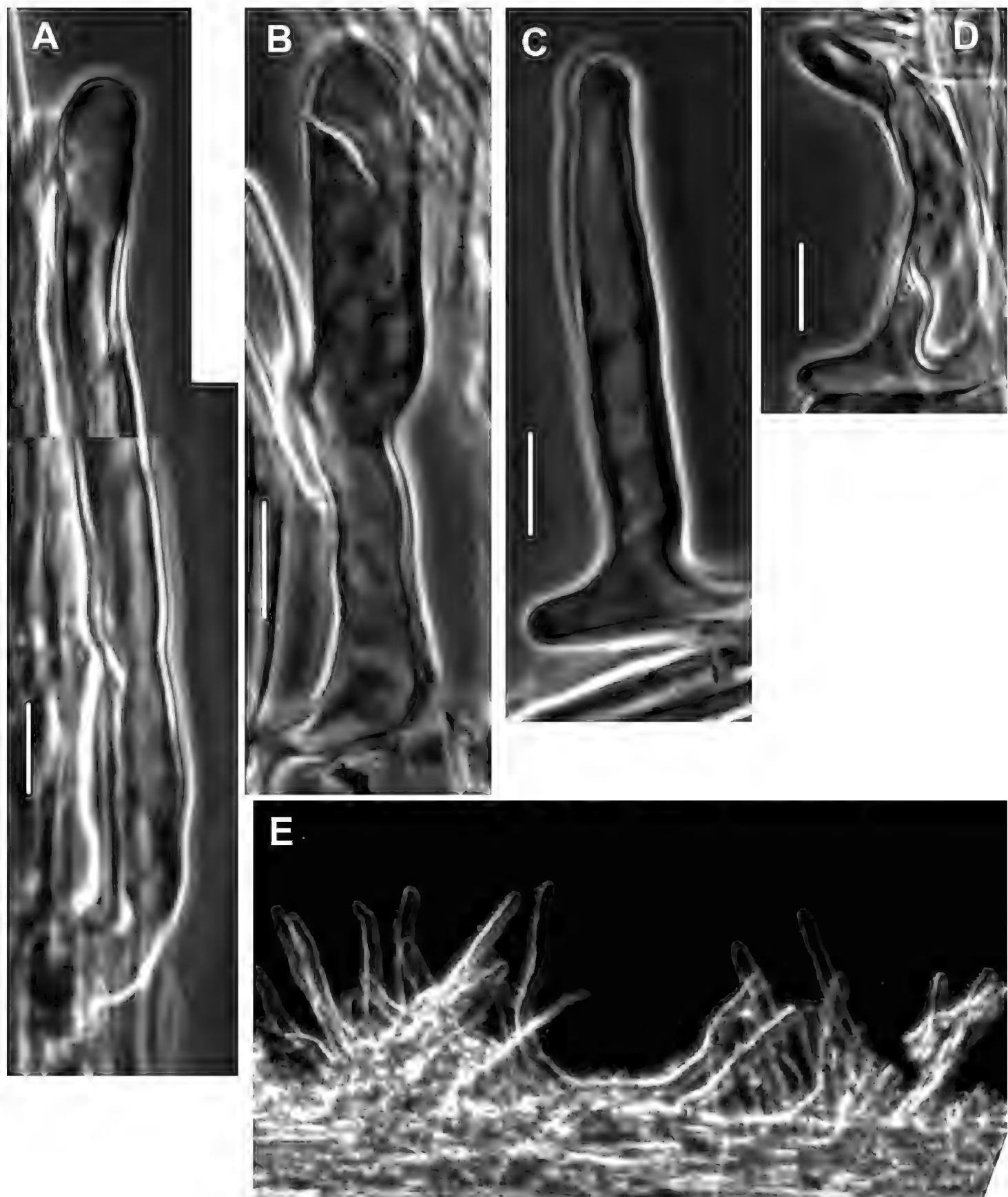
Their photo, however, has a suggestion of many more lamellae. As the description above reports, total lamellae and through lamellae statistics do not agree.

Pleurocystidia are apparently produced by selected basidiomata and not by others. The specimen from Austria produced large numbers of differentiated pleurocystidia, but TFB 4731 does not exhibit mature pleurocystidia. Immature pleurocystidia may be present and common, but they are indistinguishable from basidioles. When basidia are nearing maturity they begin to exhibit the heterogeneous contents typical of the species.

TENN-F-55620 was used by Vasiliauskas et al. (2005) as a representative to AF-TOL (GenBank AY781252).

Unlike *My. scorodonius*, which exhibits common differentiated pileocystidia (modified broom cell-like termini) at the pileus margin, the pileipellis of *My. alliaceus* extends from pileus margin to center with no differentiation of a second element. The most differentiation observed has been some adventitious apical growths from otherwise typical inflated shapes.

**Specimens examined.** **Austria**, Lower Austria, Waldviertel Forest, vic Dobrasperre, N48°38.477', E15°48.338', 24.IX.2001, coll. RHP, TFB 11451 (TENN59312). **France**, Rhone-Alpes, Dpt. Isére, Col de Granier, 11.IX.2001, coll. RHP, TFB 11352 (TENN59237). **Germany**, Thuringia, vic. Muchinsojra, Helbeta, N51°24.131', E10°36.052', 30.VIII.2012, coll RHP, TFB 14161 (TENN67911). **Russia**, Kras-



**Figure 10.** *Mycetinis alliaceus*. Caulocystidia from upper stipe. **A** Repent caulocystidium against stipe surface **B-D** Caulocystidia perpendicular to stipe surface **E** General view of lower stipe surface. Standard bars = 10 µm. TFB 11451 (TENN-F-59312).

nodar Region, vic. Plukh, slopes of Krasnaya Polya, N43°38.677', E40°26.668', 20.IX.1996, coll RHP, TFB 8960 (TENN55620). **Sweden**, Halland Co., vic Töto Parish, N56°53'50", E12°48'11.5", coll unknown, TFB 4731 (TENN50328); Västergötland, Partille Parish, Jonsered (15 Km east of Gothenburg), N57°44'50", E12°10'25", 28.IX.1991, coll SA Gordon, RHP, Robert Daun, TFB 4737 (TENN50334).

**2. *Mycetinis appplanatipes* (Desjardin) A.W. Wilson & Desjardin. 2005. Mycologia 97: 677.**

**Basionym:** *Marasmius appplanatipes* Desjardin. 1985. Mycologia 77: 899-900.

**Diagnosis.** 1) Basidiomata of small to moderate size (pileus 10–18 mm broad; stipe 30–40 × 1.5–3 mm); 2) pileus disc reddish brown, margin greyish orange; 3) strong alliaceous odor and taste; 4) entirely vested, bicolored stipe, typically compressed; 5) cheilocystidia poorly differentiated, clavate to occasionally bifid; 6) spores broadly ellipsoid to subamygdaliform.

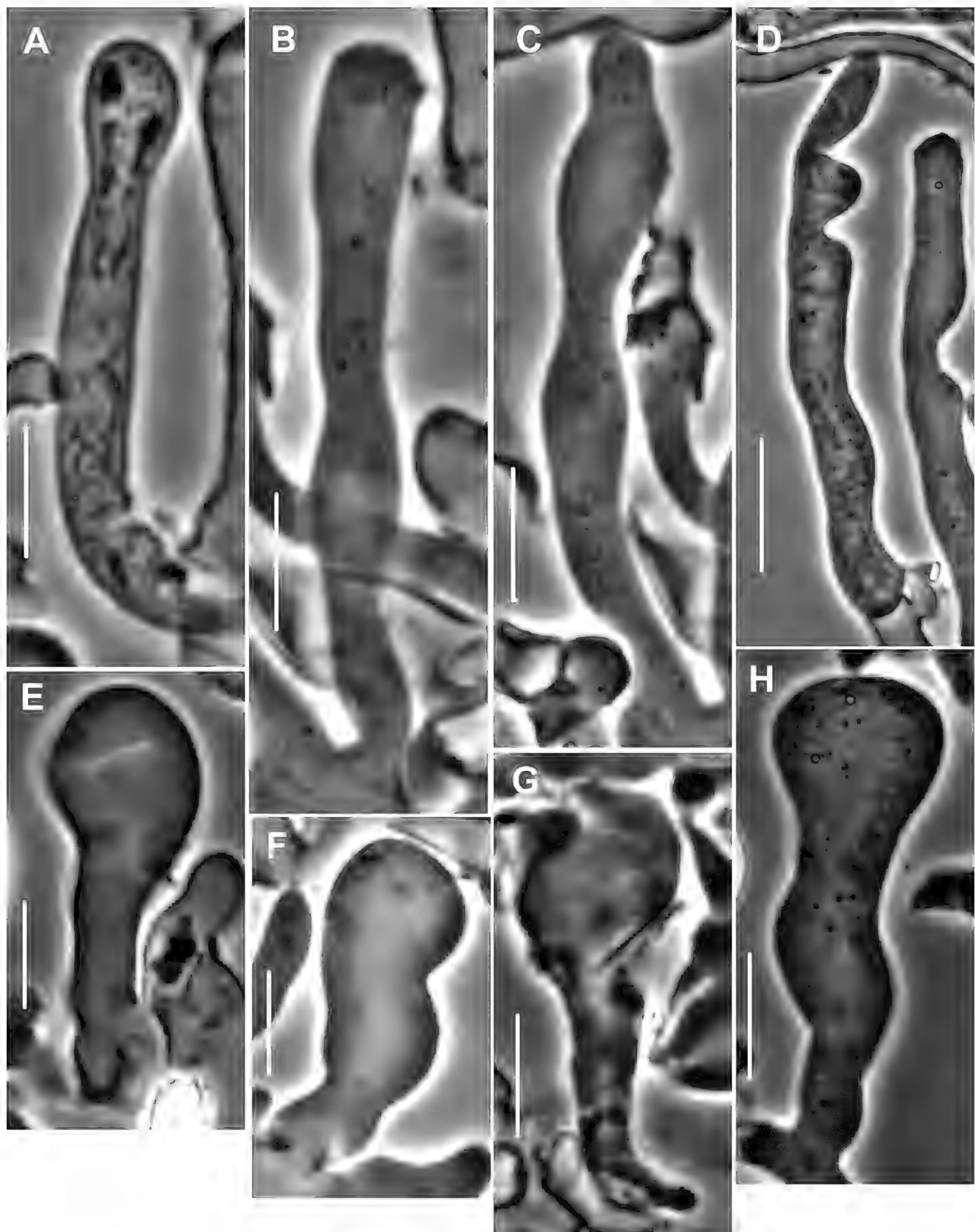
**Description.** **Basidiomata** (Fig. 11) of small to moderate size. **Pileus** 10–18 mm broad, when young strongly convex, in age becoming shallowly convex to plane, rarely shallowly everted, dry, dull, glabrous, subtly subhygrophanous; disc dark reddish brown (8F4–8) overall when young, in age disc remaining dark brown (7F4–8), brown (7E4–6) or light brown (7D5–7); margin incurved when young, becoming decurved to uplifted, entire, even, smooth to minutely rugulose-striate to short sulcate, fading to brownish gray (6C3), greyish orange (5–6B2–4) or pinkish buff. Pilus trama up to 1 mm thick, soft, brown to brownish grey. **Lamellae** adnate to adnexed, often attached to an adherent pseudocollarium (best seen in dried material), subdistant to distant, thick, total lamellae 40–50, through lamellae 13–16, medium broad to broad (1–2.5 mm broad), rarely anastomosing and intervenose, (fresh) at first buff or orange white (5A2) to greyish orange (5–6B3), mellowing with age, often becoming brown (7E4–5), (dried) “cartridge buff” 30A2, “cream buff” 4A4, “chamois” 4B4; edge even, entire, wavy in age, paler than faces when dried; lamellulae in 1–2 series. **Stipe** 30–40 × 1.5–3(–4) mm, when young terete and equal, in age becoming compressed and often cleft, typically tapered downward, cartilaginous, hollow, non-insititious, upward pubescent, velutinous in midsection, at base subtomentose to tomentose, with tomentum intricately tangling with substrate, when young, upward buff to orange white (5A2), in age brownish orange (8E4–7), in midsection brownish grey (6C3), downward brown (6–7E5–7) to reddish brown (8E4–8), base dark brown (7B4–8) to dark reddish brown (8F4–8); medulla concolorous with stipe surface. **Rhizomorphs** and sterile stipes not reported. **Odor** and **taste** strongly alliaceous.

**Habitat and phenology.** Scattered, densely gregarious to subcespitoso in duff under mixed conifers (mainly species of *Pseudotsuga*, *Abies concolor* and *Pinus contorta*) at elevation above 6000 feet in Sierra Nevada and Cascade Range in California; uncommon; Oct–Nov.

**Pileipellis** from near pileus margin a roughly hymeniform layer ~50 µm thick composed of several elements: 1) pileal hairs (Fig. 11A–D) 30–90 × 4–6.5 µm, arising as side branches of repent subpellis hyphae, very delicately roughened, occasionally internally clamped, sometimes undulate or shallowly lobate, thin-walled; contents densely homogeneous to heterogeneous; 2) inflated hyphal termini (Figs 11E–H, 12, 14A–B) 24–50(–65) × 5–14 µm, stalked, ranging from ventricose-rostrate, subglobose to elongate or complex-lobate, firm-walled, conspicuously clamped, firm-walled

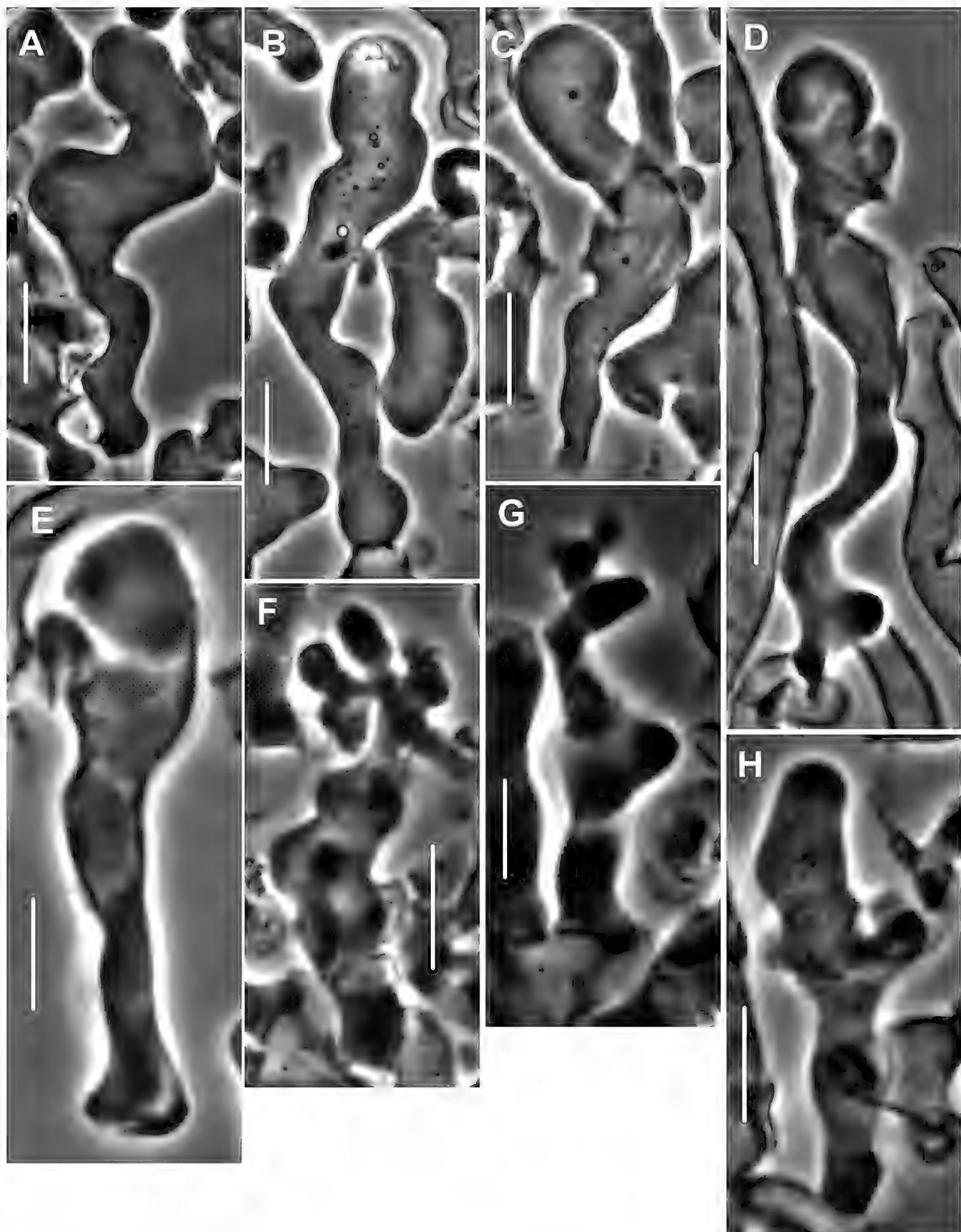


**Figure 11.** *Mycetinis appplanatus*. Basidiomata. Standard bars = 10 mm. DED 2330 (SFSU). Courtesy Dennis Desjardin.



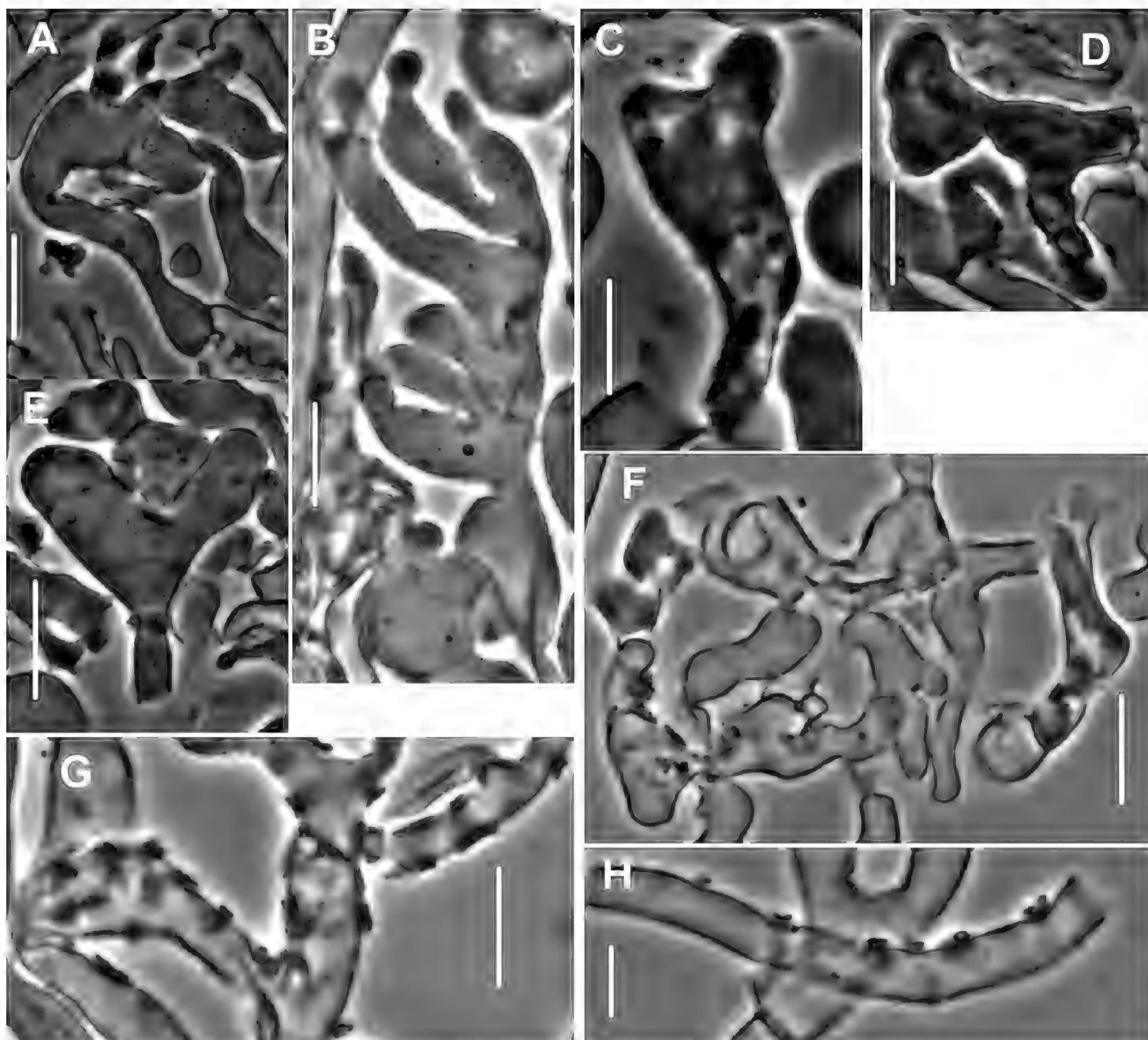
**Figure 12.** *Mycetinis appplanatus*. Pileipellis structures. **A–D** Pileal hairs **E–H** Inflated hyphal termini. Standard bars = 10  $\mu\text{m}$ . DED 6628 (SFSU-F- 024637).

(wall -0.6  $\mu\text{m}$  thick, hyaline; 3) similar scattered elements with dense contents, usually branched or lobate; and 4) scattered thick-walled lobate elements (Fig. 14C, D) with densely, strongly pigmented contents. Pileus trama loosely interwoven, composed of hyphae of three types: 1) filamentous, 3–8(-15)  $\mu\text{m}$  diam, firm-walled, conspicuously



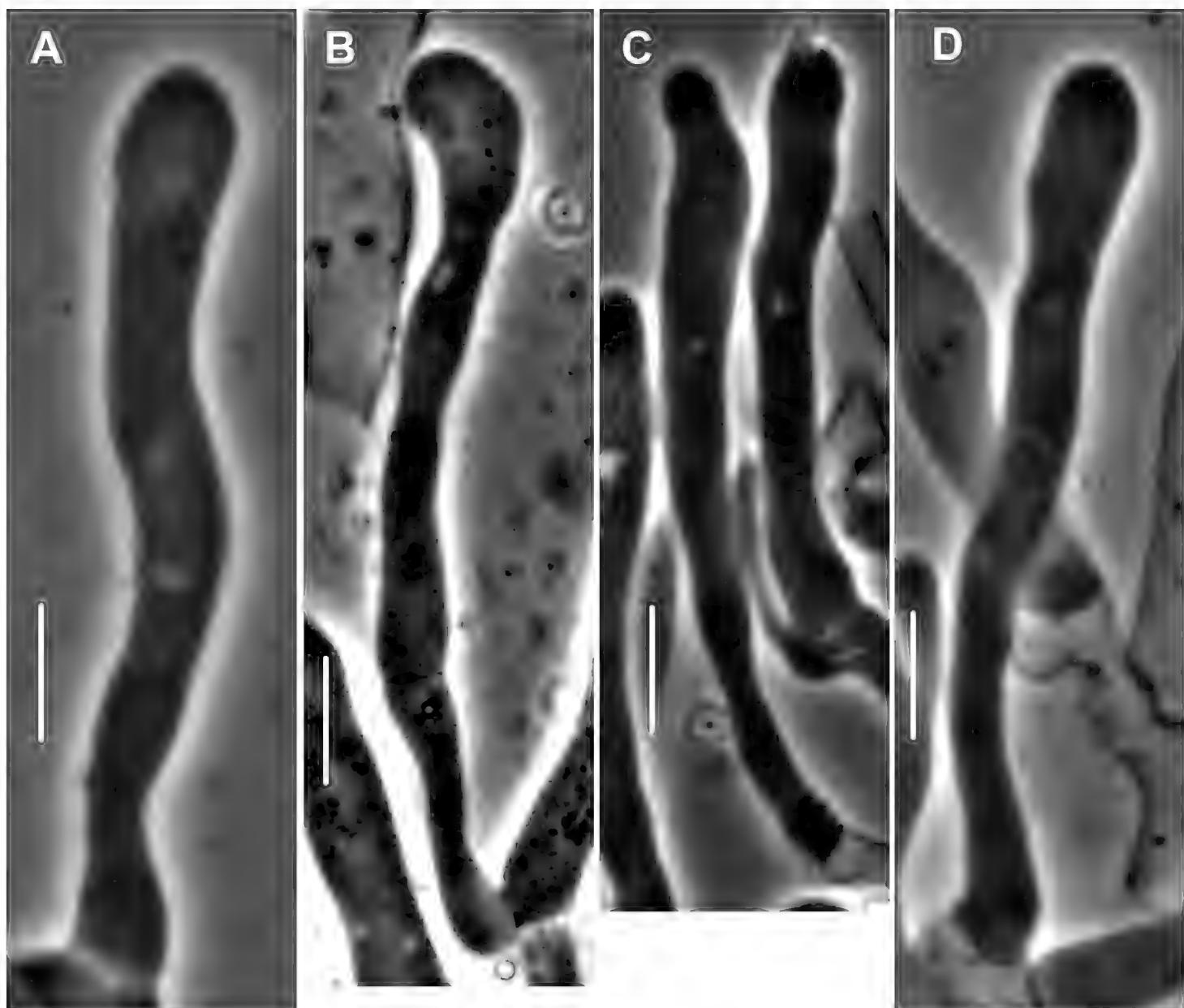
**Figure 13.** *Mycetinis applanatus*. Pileipellis structures. **A–D** Lobate hyphal termini **E–H** Structures with dense protoplasm, usually lobate or branched. Standard bars = 10  $\mu\text{m}$ . DED 6628 (SFSU-F- 024637).

clamped, often swollen at branch-points; 2) filamentous, 3–8  $\mu\text{m}$  diam, firm-walled, delicately to coarsely encrusted (Fig. 14G, H), with crust material in scabs or spiculate deposits; and 3) lobate, free-form, firm- to thick-walled (wall ~0.7  $\mu\text{m}$  thick, hyaline)

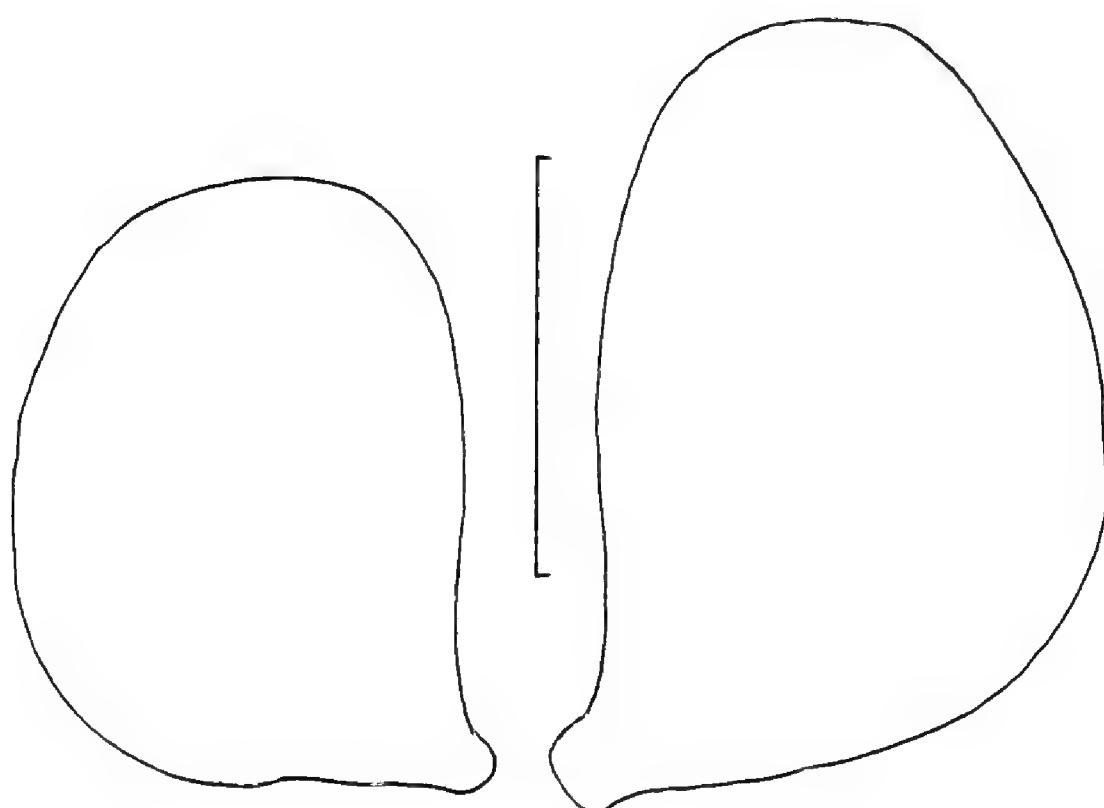


**Figure 14.** *Mycetinis appplanatipes*. Pileipellis and subpellis structures. **A, B, E** Complex lobate hyphal termini **C, D** Thick-walled, strongly pigmented elements **F** Loosely complex pileus trama hyphae **G** Encrusted hyphae **H** Detail showing spiculate crust material. Standard bars = 10 µm. DED 6628 (SFSU-F- 024637).

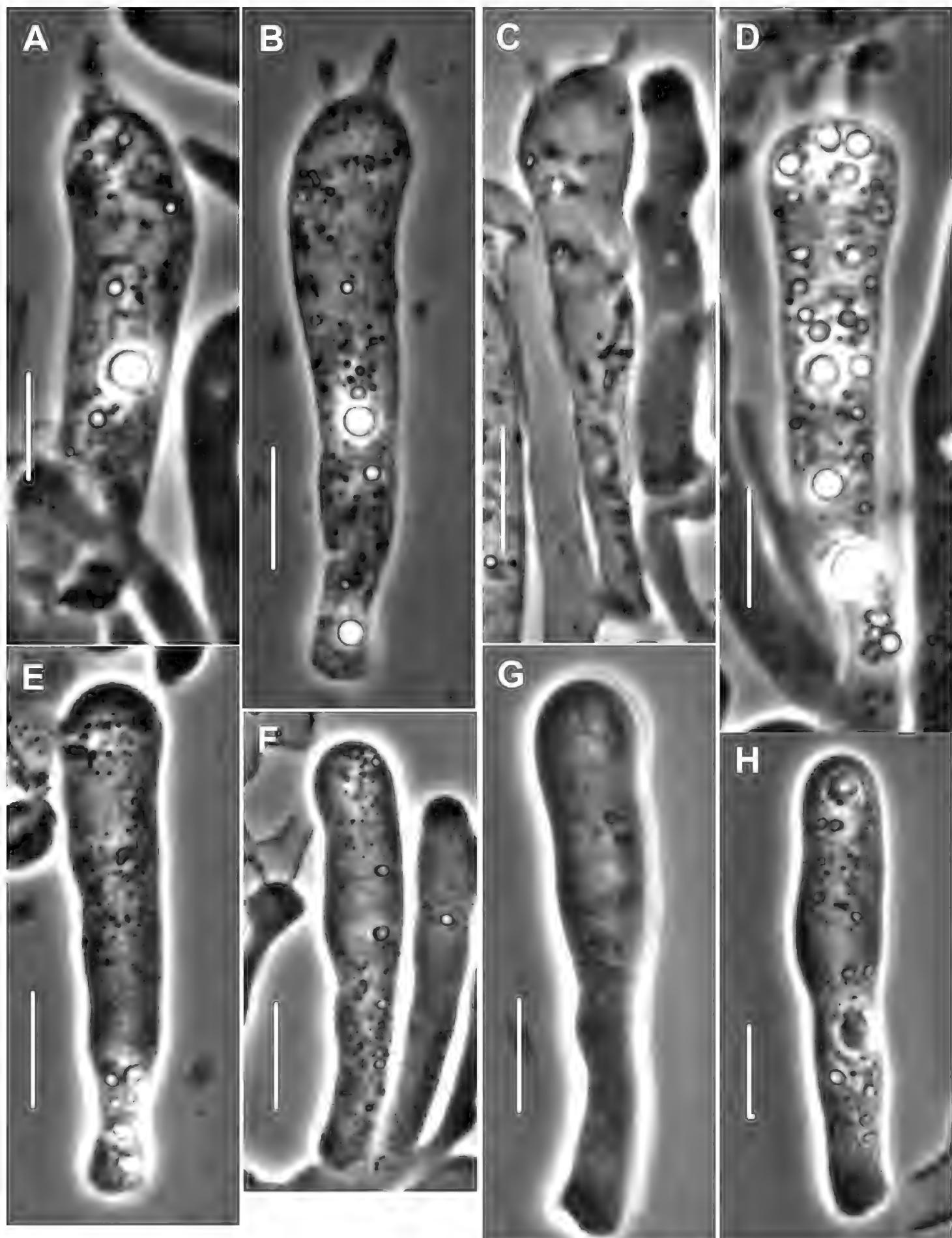
in a loose *textura intricata* (Fig. 14F). Lamellar trama subparallel to interwoven, composed of smooth, hyaline, inamyloid, cylindric hyphae 3–4 µm broad with walls up to 0.6 µm thick; conspicuously clamped. **Pleurocystidia** (Fig. 15) common (but not abundant), (35-) 40–75 × 2.5–8 µm, cylindrical to narrowly clavate or occasionally subampulliform-rostrate, conspicuously clamped; contents more or less homogeneous. Basidioles subclavate, not capitulate, conspicuously clamped; contents delicately multiguttulate, increasingly so with maturity; **basidia** (Fig. 17A–D) (35-)40–48(-59) × 7–9 µm, clavate, often subcapitulate, obscurely clamped, hyaline, with granular or globular refractive contents, (1-, 2-)4-sterigmate, with sterigmata up to 6 µm long; contents coarsely multiguttulate, refringent (PhC); some collections predominantly two-spored and these with consistently larger spores. Effete basidia not collapsing after evacuation, remaining more or less intact in hymenium (“husking”). **Basidiospores** (Fig. 16) (7.5-)8.7–10.2(-12) × 4.8–6(-6.6) µm, µm ( $Q = 1.18\text{--}1.92$ ;  $Q^m = 1.57$ ;  $L^m =$



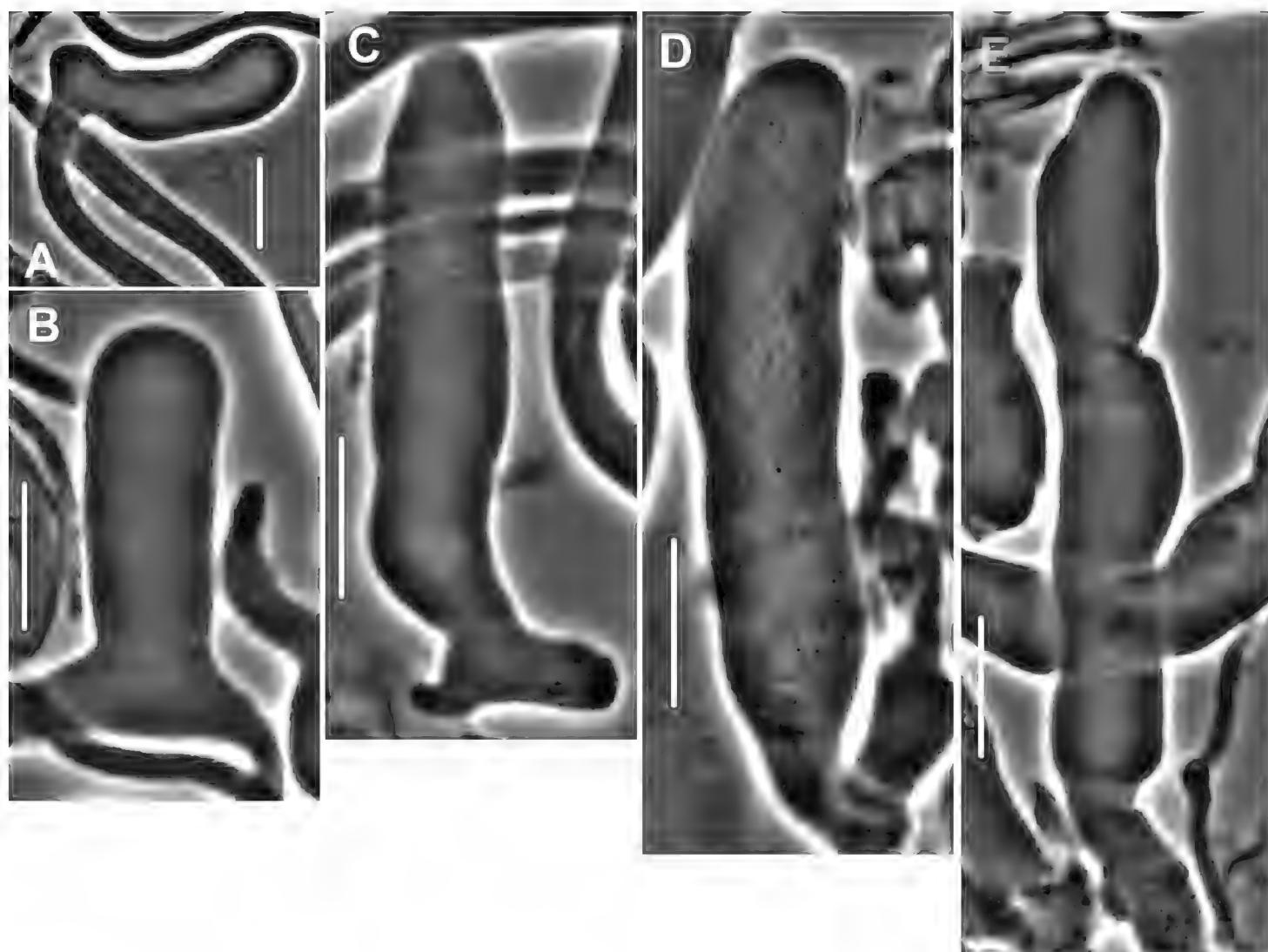
**Figure 15.** *Mycetinis applanatipes*. Pleurocystidia. Standard bars = 10  $\mu\text{m}$ . DED 6628 (SFSU-F- 024637).



**Figure 16.** *Mycetinis applanatipes*. Basidiospores. Standard bars = 5  $\mu\text{m}$ . DED 6628 (SFSU-F- 024637).



**Figure 17.** *Mycetinis applanatipes*. Basidia and cheilocystidial structures. **A** Monosterigmate basidium **B, C** 2-sterigmate basidia **D** 4-sterigmate basidium **E-H** Cheilocystidial structures. Standard bars = 10  $\mu\text{m}$ . DED 6628 (SFSU-F- 024637).



**Figure 18.** *Mycetinis appplanatipes*. Caulocystidia from stipe apex. **A** Caulocystidium as hyphal terminus **B** Caulocystidium as side branch **C-E** Individual caulocystidia. Standard bars = 10  $\mu\text{m}$ . DED 6628 (SFSU-F- 024637).

9.2  $\mu\text{m}$ ), pip-shaped, broadly ellipsoid to amygdaliform, hyaline, smooth, inamyloid, white in deposit. **Cheilocystidia** (Fig. 17E–H) scattered, uncommon, 33–48(–56)  $\times$  6–10  $\mu\text{m}$ , clavate to cylindric-subcapitulate or bifid with two lobes typically unequal in length and occasionally with a few short lateral knobs, with thin, hyaline, inamyloid walls, obscurely clamped, easily disarticulated; contents delicately to coarsely multiguttulate. **Stipe medullary hyphae** parallel, 2.5–12  $\mu\text{m}$  diam, thin-walled (wall hyaline to pale yellowish brown, inamyloid, walls up to 0.6  $\mu\text{m}$  thick), conspicuously clamped; stipe cortical hyphae 2–4.5  $\mu\text{m}$  diam, strictly parallel, firm-walled, hardly pigmented, producing caulocystidia as side branches and/or hyphal termini. **Caulocystidia** of upper stipe surface (Fig. 18) (26-)40–100  $\times$  9–15  $\mu\text{m}$ , arising as hyphal termini or side branches, broadly cylindrical, undulate, apically bluntly rounded, hyaline, perpendicular to stipe surface, narrowed somewhat at origin, firm-walled, in clusters or scabs so appearing as delicate floccose scales; contents more or less homogeneous, non-refrangent (PhC); caulocystidia of basal tomentum with dark brown, evenly pigmented walls up to 1.2  $\mu\text{m}$  thick.

**Commentary.** Numbers of through lamellae is somewhat low for *Mycetinis*, but the single rank of rudimentary lamellulae is consistent with other species. Stipe length/pileus diameter ratio is rather low (i.e. stipes are somewhat short, but robust for their

length), with several other taxa rather gracile. Habitat on mixed conifer needles is also uncommon, with several other taxa on deciduous leaves or rotten buried wood.

Unexpectedly, the ITS sequence of DED 6628 is close to that of *M. prasiosmus* from Europe (minimum percent difference = 2.19%). Numerous non-molecular characters differ, however, include basidiomatal size and stature, ecological niche and distribution.

**Specimens examined.** United States, California, Placer Co., Yuba Gap, Hwy 80, N39°18'55.66", W120°37'08.15", 6.XI.1983, coll. & det. DE Desjardin (as *Marasmius applanatipes*), DED 2469 (SFSU-F- 024633) California, Sierras Co., Chapman Creek Campground, off Hwy 49, N39°37'49.85", W120°32'37.80, 4.X.1997, coll. Desjardin & Perry, det. DE Desjardin, DED 6628 (SFSU-F-024637); Sierra County, Yuba Pass, N35°19'23.65", W120°35'56.92", 8.X.1983, coll. & det. DE Desjardin, DED 2330 (as *Marasmius applanatipes*) (SFSU-F- 000646; holotype p.p.); Siskiyou Co., vic. Callahan [N40°18'45", W122°48'05"], Carter Meadow, 20 mi W of Weed, 1.X.1983, coll. & det. DE Desjardin, DED 2236 (SFSU-F- 024634).

### 3. *Mycetinis cinnamomeus* (Cleland) R.H. Petersen & Desjardin, comb. nov. Index Fungorum no. 553203

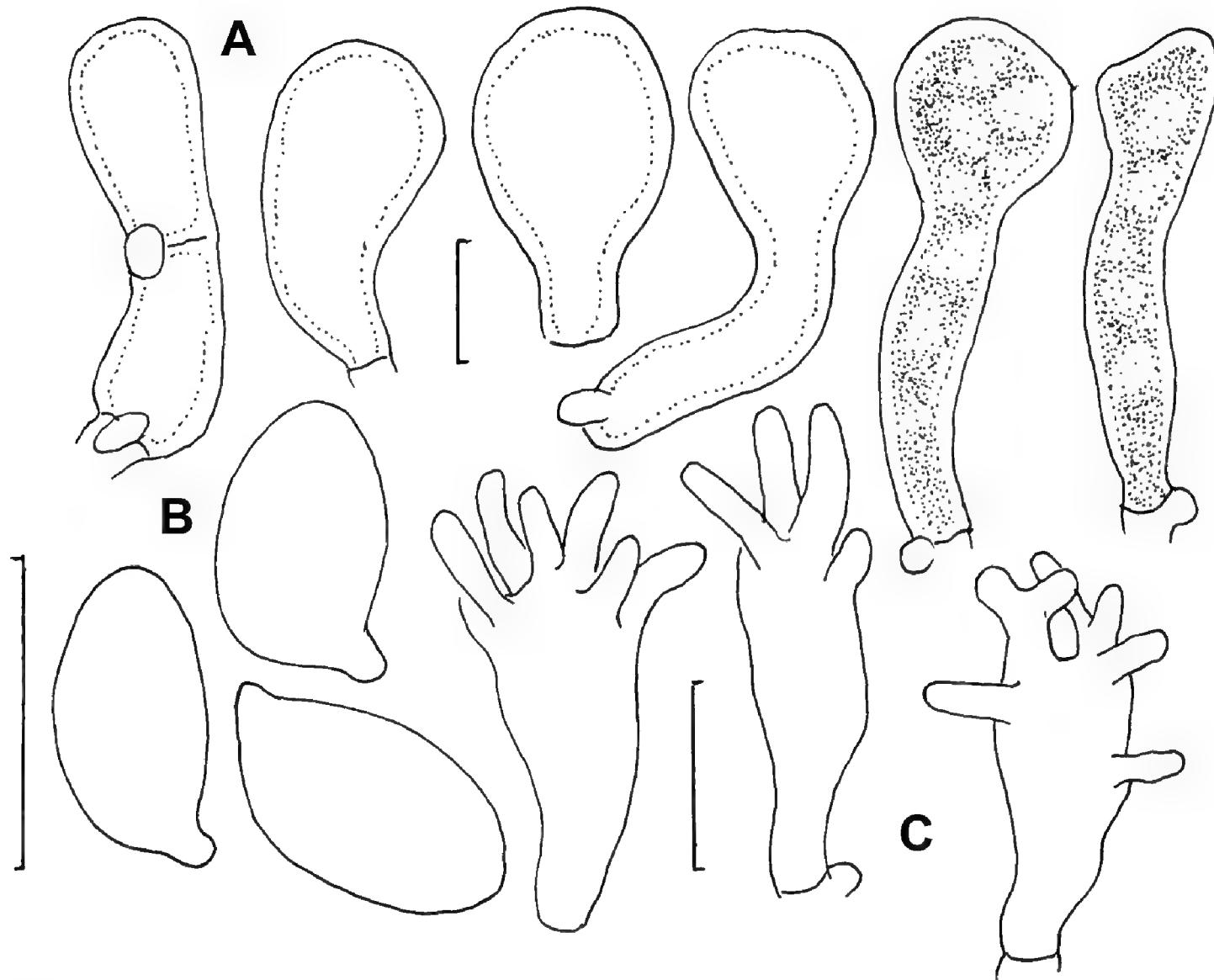
**Basionym:** *Marasmius cinnamomeus* [as “*cinnamoneus*”] Cleland. 1934. Toadstools & Mushrooms and other larger fungi of South Australia (addenda) 1: 132. [non Cleland. 1934. Trans. Roy. Soc. S. Australia 58: 213].

**Type** [lectotype, design. (Grgurinovic 1997)]: **Australia**, South Australia, Belair Nat. Park, S35°00'44.79", E138°38'54.54", 7.VII.1934, coll. J.B. Cleland, Cleland no 10002 (AD 10986).

**Diagnosis.** 1) Basidiomata diminutive (pileus 4–12 mm broad; stipe 6–12(-25) × 0.6–1 mm); 2) pileipellis hymeniform, of firm- to thick-walled inflated hyphal termini; 3) basidiospores broadly ellipsoid to subamygdaliform; 4) caulocystidia absent; 5) reported lack of odor; 6) habitat on bark of living eucalypts; 7) fruiting in late autumn to winter; South Australia.

The following description is a combination of the protolog, Grgurinovic's (1997) treatment and Desjardin's notes (pers. comm.) on three Cleland specimens.

**Description.** **Basidiomata** diminutive. **Pileus** -12 mm broad, at first convex with inturned margin, then nearly plane, “light pinkish cinnamon” 7A2, “pinkish buff” 6A3, “light vinaceous cinnamon” 7A3 or “light ochraceous salmon” 6A4, darker over the disc; surface dull and slightly villose or minutely frosted, subrugose, sometimes shallowly substriate at margin. **Lamellae** adnate, then seceding, moderately close to somewhat distant, presence or absence of pseudocollarium unreported, slightly ventricose, cream-colored or white; edge sometimes appearing delicately serrulate. **Stipe** -12(-25) × 0.6–1mm, subinsititious, slender, slightly velutinous or smooth, near “Hessian brown” 9E7 or “Vandyke brown” 7E6, paler above, downward darker, sometimes nearly black below. **Odor** reported as negligible; **taste** not recorded.



**Figure 19.** *Mycetinis cinnamomeus*. **A** Pileipellis elements **B** Basidiospores **C** Cheilocystidia. Standard bars = 10 µm. From Desjardin notes on AD 31401.

**Habitat and phenology.** Gregarious on thick bark at the bases of living eucalypts; South Australia; May-July.

**Pileipellis** (Fig. 19A) more or less a hymeniform layer of inflated hyphal termini not involved in a slime matrix; cells clavate, obpyriform, sphaeropedunculate, molar-shaped to coarsely lobed, firm- to thick-walled (wall 0.5–2.5 µm thick), occasionally with irregular short apical diverticula, hyaline to golden brown; diverticula 15.2–29.6 × 7.8–13.6 µm. Subpellis hyphae cylindrical, not encrusted, conspicuously clamped. **Pleurocystidia** not reported but probably narrowly fusiform as in other taxa of the genus. Basidioles clavate; **basidia** 24.0–32.0 × 6.2–10.0 µm, clavate, sometimes versiform in midsection, 2–4-sterigmate; sterigmata -6.0 µm long. **Basidiospores** (Fig. 19B) 7.2–10.2 (-12) × 3.4–5.1(-6.2) µm [ $Q^m = 2.0$ ;  $L^m = 8.4$  µm], ellipsoid, subovate to subamygdaliform, smooth, thin-walled, inamyloid. Lamellar edge fertile; **cheilocystidia** (Fig. 19) scattered, (11.2-)18.4–33.6 × 5.6–16 µm, broadly clavate, hyaline, firm-walled, clamped; main body 13–20 × 7–9 µm, hyaline, diverticulate; diverticula 3–8 × 1.5–3 µm. Stipe cortical hyphae 3–6.5 µm diam, parallel, cylindrical, thick-walled, orange brown, with granular to annular encrustation. **Caulocystidia** absent.

**Commentary.** Desjardin and Horak (1997) drew attention to similarities between *M. curraniae* Stevenson from New Zealand and *M. cinnamomeus* from South Australia. Since then, *M. curraniae* has been recombined into *Mycetinis* (Cooper and Leonard 2012) and molecular data have shown its placement with other taxa of *Mycetinis*. Unfortunately, molecular data for *M. cinnamomeus* have not yet been produced, but Cleland's report of "odour none" notwithstanding, all other characters point to its inclusion with other taxa of *Mycetinis*, especially those with diminutive basidiomata (i.e. *M. olidus*, *M. yunnanensis*). The proposed nomenclatural new combination is intended to bring this additional taxon into *Mycetinis*.

Grgurinovic (1997) translated Cleland's (1934) Latin description into English, adding observations on microstructures.

As is common for some other taxa of *Mycetinis*, *M. cinnamomeus* was considered by Grgurinovic (1997) as belonging in *Marasmius* sect. *Epiphylli*, and Desjardin and Horak (1997) indicated section *Chordales* (by implication of similarity to *M. curraniae*). Other than literature cited here, little is known about Cleland's taxon. It seems to have eluded collection since Cleland's finds. The diminutive basidiomata seem similar to those of *M. virgultorum*, *M. olidus*, *M. curraniae* and *M. yunnanensis*.

Cleland (1934) listed four locations as distribution of *M. cinnamomeus*: Belair National Park ( $S35^{\circ}00'44.79''$ ,  $E138^{\circ}38'54.54''$ ), Willunga Hill ( $S35^{\circ}18'44''$ ,  $E138^{\circ}34'35''$ ), Mt. Lofty ( $S34^{\circ}58'25.65''$ ,  $E138^{\circ}42'32.25''$ ) and Inman Valley ( $S35^{\circ}28'00.30''$ ,  $E138^{\circ}27'19.06''$ ). Both Grgurinovic (1997) and Desjardin (unpubl.) examined AD 10986, while Desjardin examined two additional specimens.

Spore dimensions by Cleland (1934) and Grgurinovic (1997) are somewhat smaller than those by Desjardin (in litt. and included above).

**Specimens examined** (by DED): **Australia**, South Australia, Willunga Hill, 31.V.? coll. J.B. Cleland, Cleland no. 10037 (AD 31401); South Australia, Belair Nat. Park, 7.VII.1934, coll. J.B. Cleland, Cleland no 10002 (AD 10986, lectotype); South Australia, National Park, 28.V.1927, coll. J.B. Cleland, Cleland no. 392 (AD 31402).

#### 4. *Mycetinis copelandii* (Peck) A. W. Wilson & Desjardin 2005. *Mycologia* 97: 677.

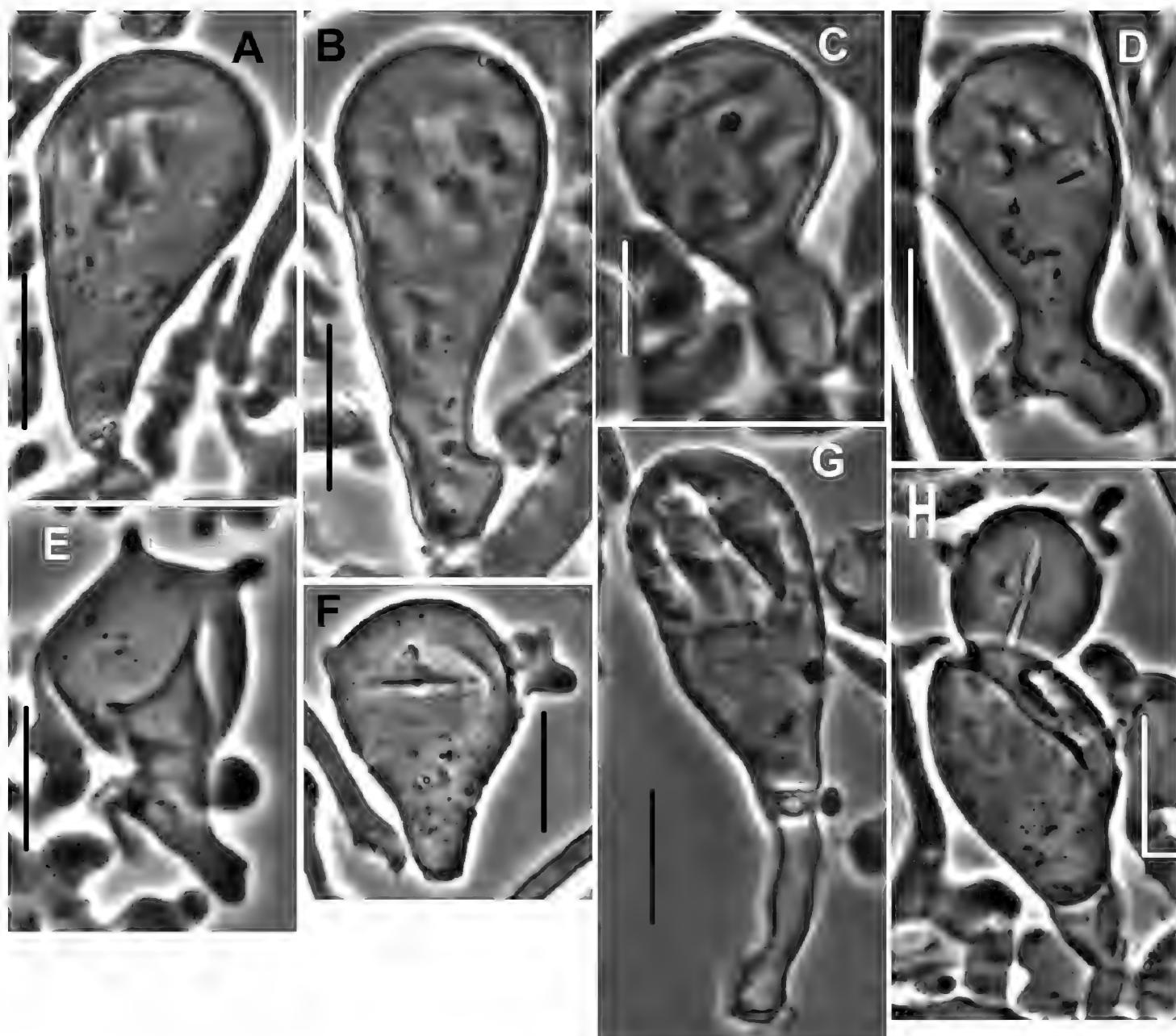
**Basionym:** *Marasmius copelandii* Peck 1904 Bull. Torrey Bot. Club 31: 182.

**Holotype.** California, San Mateo Co., Woodside, N $37^{\circ}25'49''$ , W $122^{\circ}15'12''$ , 7.XII.1902, coll. EB Copeland, Copeland 14 (herb. Peck, NYS).

**Diagnosis.** 1) Basidiomata small but robust; 2) fruiting preference on dead *Lithocarpus* leaves; 3) pileipellis constructed of broadly clavate to obpyriform cells and complex free-form textura intricata hyphal termini; 4) cheilocystidia basically clavate but often with a few prominent apical lobate outgrowths; 5) basidiospores (9-)10.5–12(-15) × 3–4(4.5)  $\mu\text{m}$ , with heterogeneous contents; 6) pleurocystidia presumptive, cylindrical to narrowly fusiform; 7) stipe entirely vested, fuzzy at base; 8) caulocystidia of two width classes; 9) distribution in northern California.

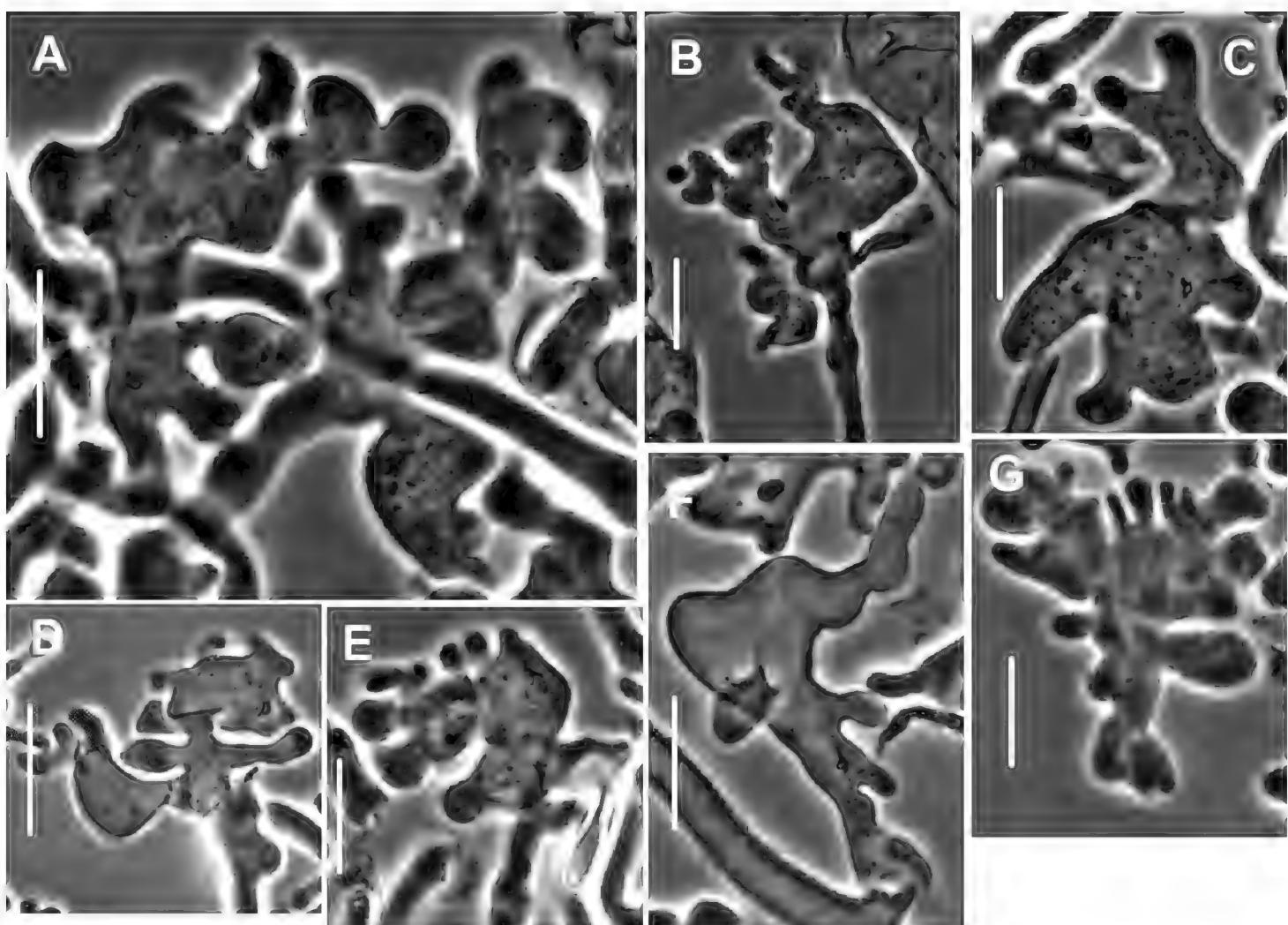


**Figure 20.** *Mycetinis copelandii*. Basidiomata. Photos courtesy of Michael Wood. Standard bars = 20 mm.



**Figure 21.** *Mycetinis copelandii*. Pileipellis elements. **A–D, G** Broadly clavate individuals without outgrowths **E, F, H** Individuals with lobose outgrowths. Standard bars = 10  $\mu\text{m}$ . TFB 8084 (TENN-F-55408).

**Description.** Basidiomata (Fig. 20) small but robust. **Pileus** (4-)8–24 mm broad, convex when young, becoming shallowly convex, plane to shallowly everted in age, smooth, dry to moist, subglabrous, usually entirely fading in color in age; disc “Verona brown” 6E5, “bone brown” 7F8, “Sudan brown” 6E7, “Argus brown” 6E8, “auburn” 7E5, “Vandyke brown” 7E6, “burnt umber” 7E7, to “Kaiser brown” (6-7E5-8) when young, fading to near “buffy brown” 6D4-5, near “buckthorn brown” 5C5-7 or near “drab” 6C4 in age; margin at first incurved, entire, even, “buffy brown” 6D4-5, “Rood’s brown” 6-7D4-5, soon becoming decurved, shallowly translucent-striate, in age rugulose-striate, near “tilleul buff” 5B4 or “pale cinnamon pink” 5A2-3; trama 0.5–1 mm thick, near “sayal brown” 6C3. **Lamellae** adnate to adnexed, close to sub-distant (13–16 reach the stipe), thickish, occasionally pseudocollariate, subventricose, shallow (1–1.5 mm width), rarely forked or intervenose, at first “pale cinnamon pink” 5A2, becoming near “tilleul buff” 6B3 in age, often spotted “Rood’s brown” 7D5-6 to “vinaceous russet” 8D4, developing necropigment of “light ochraceous buff” 5A4; edges even and entire when young, concolorous with or slightly paler than the faces;

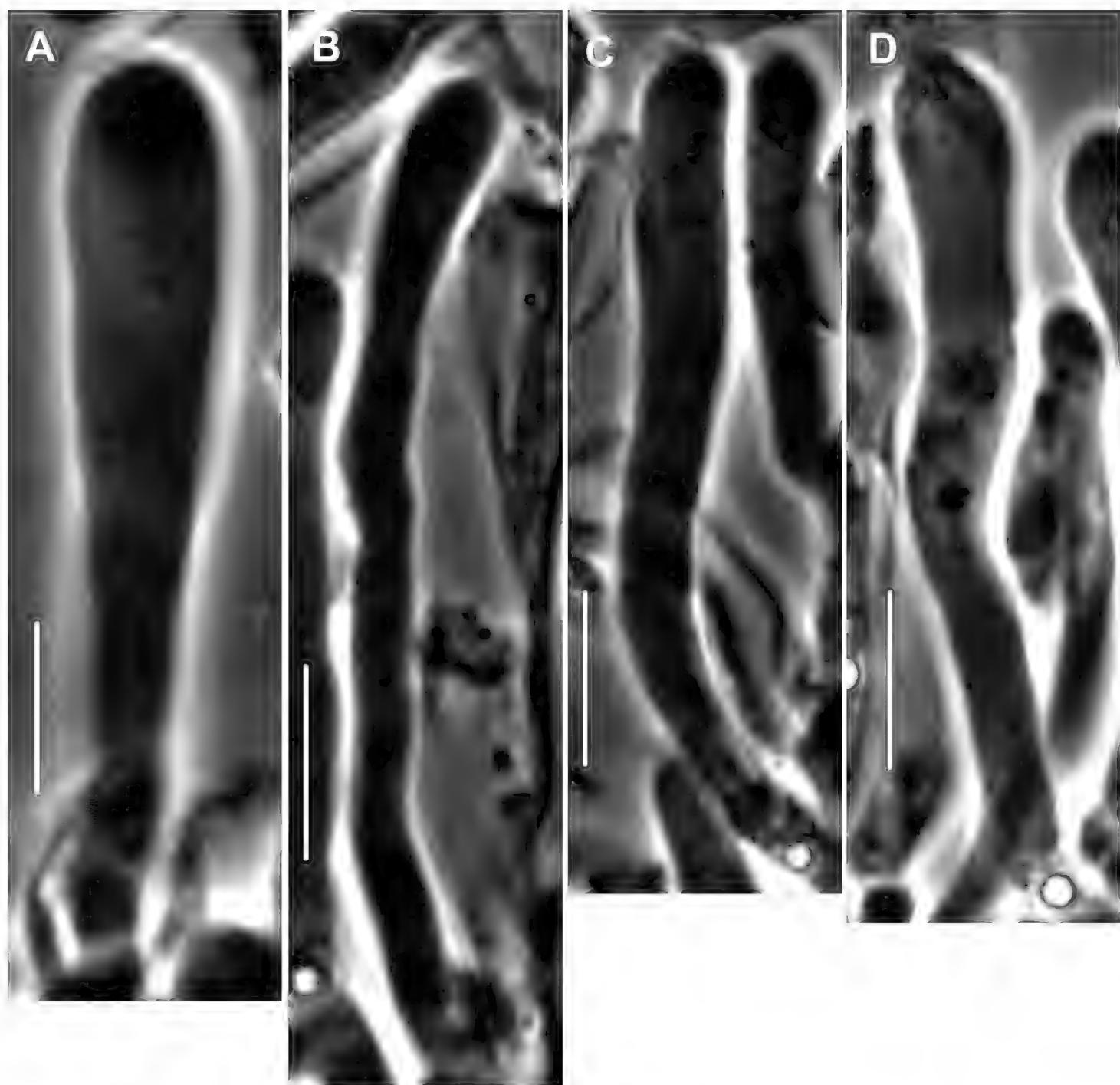


**Figure 22.** *Mycetinis copelandii* Pileipellis elements. Free-form, lobose individuals. Standard bars = 10 µm. TFB 8084 (TENN-F-55408).

lamellulae in 1–2 series. **Stipe** (15-)25–65(75) × 1–4 mm, terete when young, often becoming compressed in age, equal or tapered somewhat downward, non-insititious, occasionally somewhat rooting, tough, pliant, hollow to stuffed, vestured overall, pruinose to pubescent upward and there “pale cinnamon pink” 5A2 when young, becoming slightly darker in age, in midsection pubescent to velutinous, near “drab” 6C3, “wood brown” 7C4 or “Rood’s brown” 7D5-6, “walnut brown” 7D4-6, downward to base tomentose, “auburn” 7E5, “Vandyke brown” 7E6, “burnt umber” 7E7, “Kaiser brown” 7E5-8, “blackish-brown(1)” 7F5, “warm sepia” 7E6, “carob brown” 7E7, “bone brown” 7F5-8 or “seal brown” 8F4-5. **Rhizomorphs** rare, obscure, -6 × 0.5–1.0 mm, black, strap-shaped, occasionally branched; short, narrow disarticulated stipes rare to abundant. **Odor** strongly of garlic but ephemeral; **taste** strongly alliaceous, persisting in herbarium specimens.

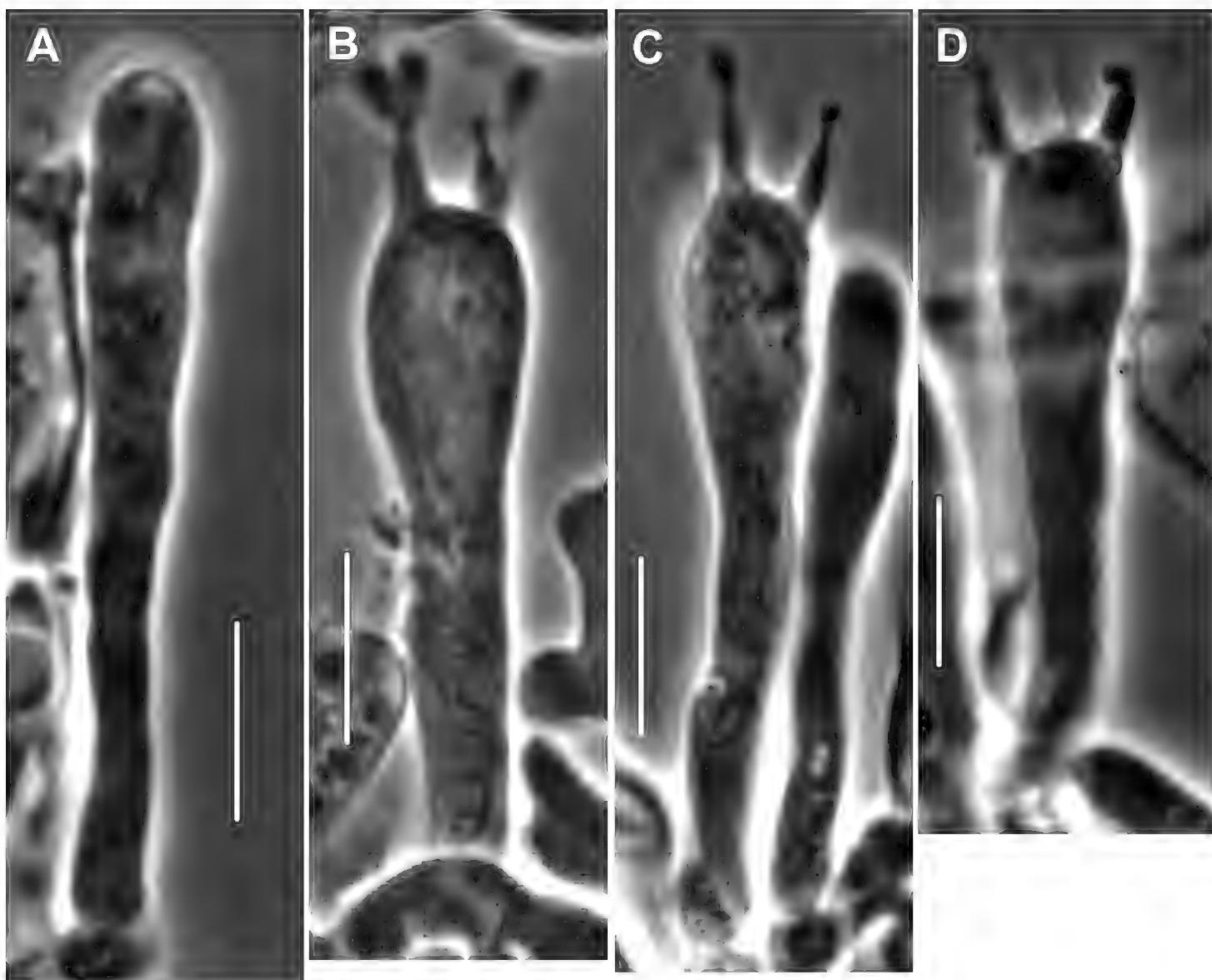
**Habitat and phenology.** Gregarious to densely gregarious, clustered to subcespitoso on or among senescent leaves of *Quercus*, *Castanopsis* and *Lithocarpus* in mixed, coastal forests; common; October-January.

**Pileipellis** (Fig. 21) a roughly hymeniform layer of two types of smooth cells: 1) broadly clavate to vesciculose, sphaeropedunculate, obpyriform or irregularly lecythiform cells 13–33(-90) × 6.6–14.4(18) µm, smooth to minutely roughened, occasionally with adventitious conical to lobate outgrowths, seldom lobed or bifid, firm-



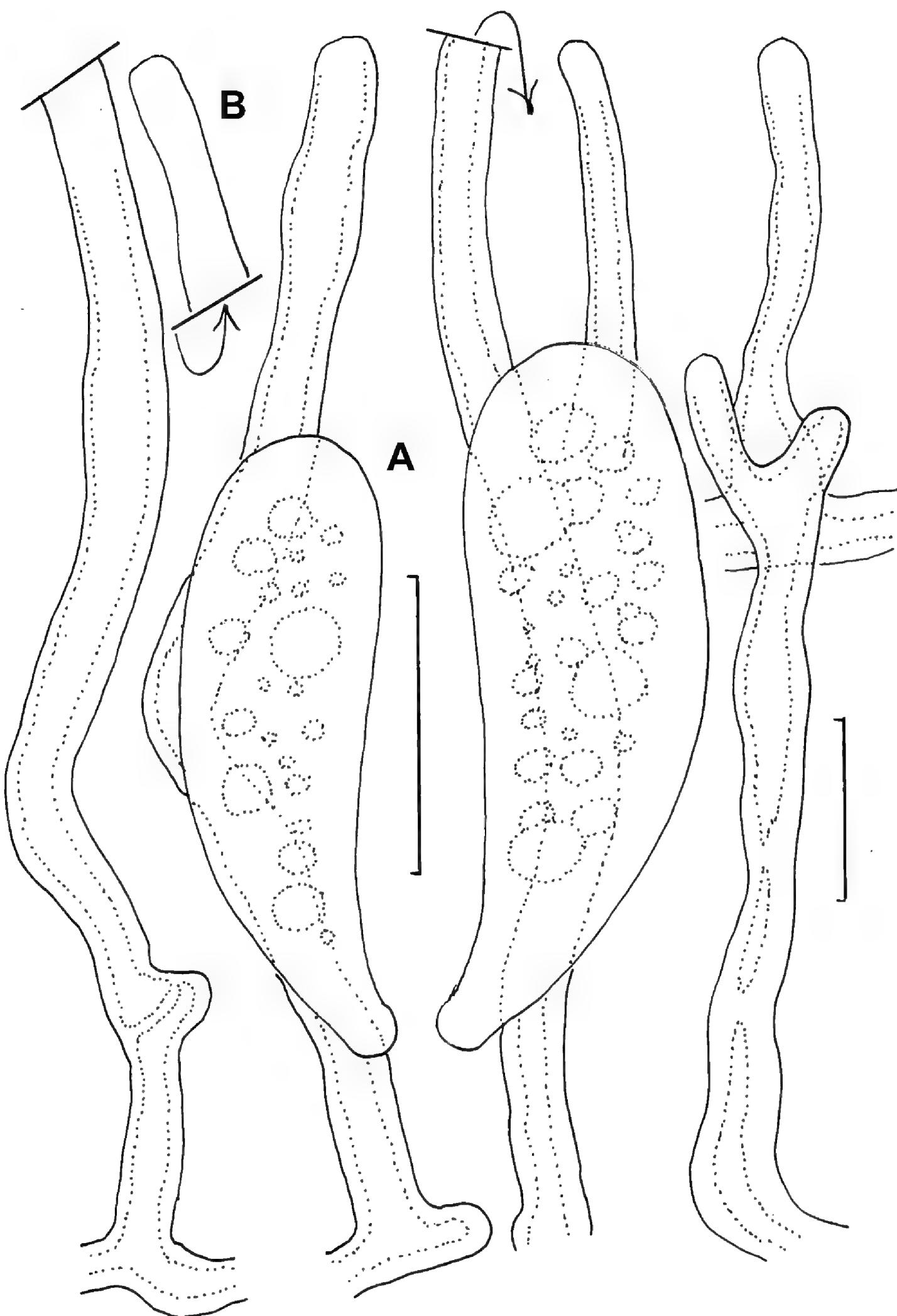
**Figure 23.** *Mycetinis copelandii*. **A** Immature basidium **B–D** Presumptive pleurocystidia. Standard bars = 10  $\mu\text{m}$ . TFB 8084 (TENN-F-55408).

to thick-walled (wall - 1  $\mu\text{m}$  thick), sometimes with ochraceous to brown walls up to 1.5  $\mu\text{m}$  thick; and 2) free-form lobate termini (Fig. 22), stalked (stalk 7- $<50 \times 3.5$ –6.5  $\mu\text{m}$ , inconspicuously clamped), -55  $\mu\text{m}$  broad; contents heterogeneous. Pileus and lamellar tramae loosely interwoven; hyphae of two types: 1) 2.5–5.5  $\mu\text{m}$  diam, firm-walled, conspicuously clamped; and 2) 4.5–17  $\mu\text{m}$  diam, firm-walled, usually narrowing at septa, inconspicuously clamped; contents heterogeneous. **Pleurocystidia** (Fig. 23) presumptive (see below), 25–44  $\times$  4–6  $\mu\text{m}$ , cylindrical to narrowly fusiform, conspicuously clamped; contents more or less homogeneous. **Basidia** (Fig. 24) 27–39  $\times$  6–10  $\mu\text{m}$ , usually straight and rod-like, narrowly clavate, often subtly subcapitulate, 4-sterigmate, obscurely clamped. **Basidiospores** (Fig. 25A) (9-)10.5–12(-17)  $\times$  3–4(4.5)  $\mu\text{m}$  ( $Q = 2.63$ –3.83;  $Q^m = 3.29$ ;  $L^m = 11.75 \mu\text{m}$ ), marasmoid (distally rounded, proximally tapered), sometimes slightly curved, smooth, thin-walled; con-

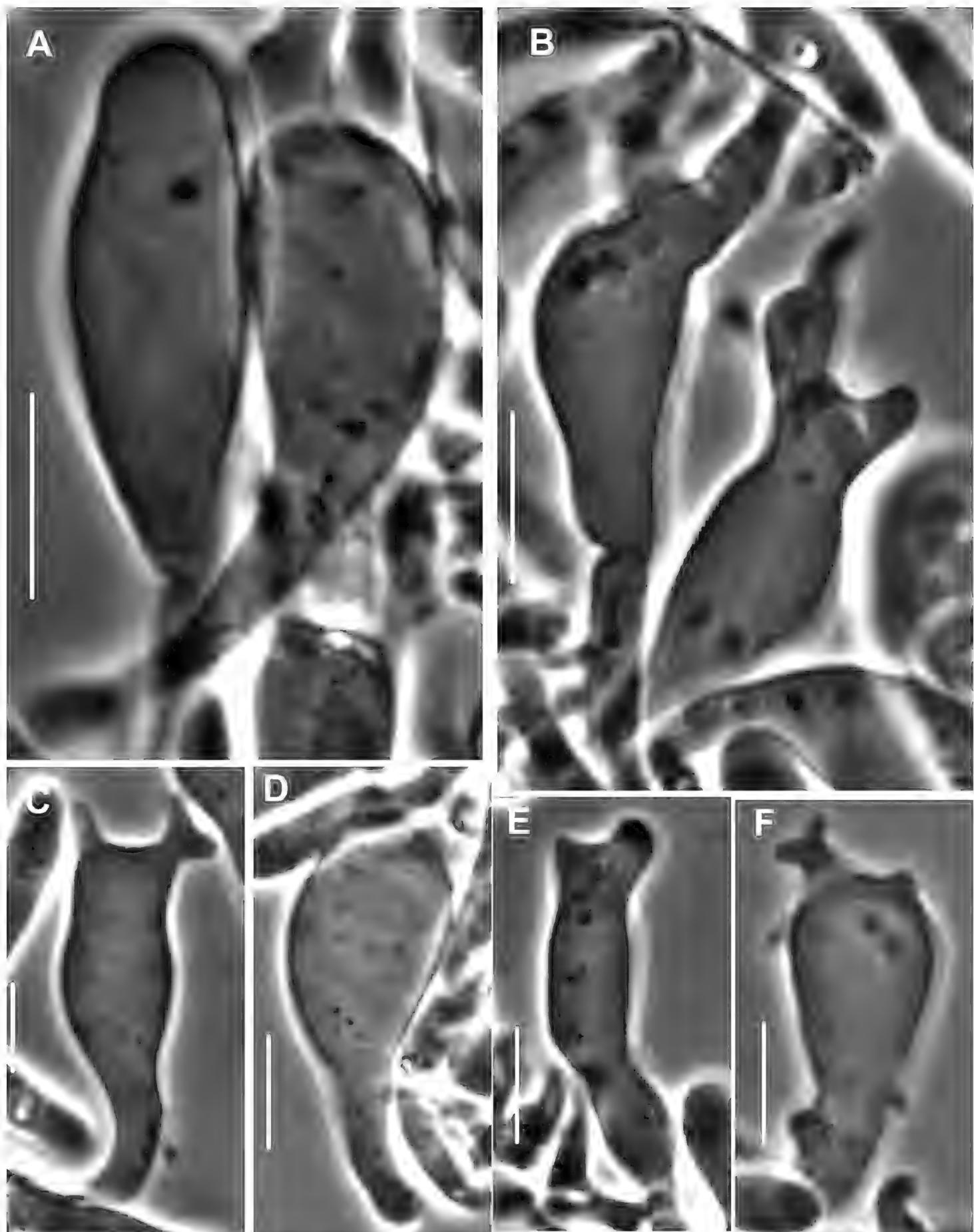


**Figure 24.** *Mycetinis copelandii*. Basidia. **A** Immature individual **B–D** Mature individuals. Standard bars = 10 µm. TFB 8084 (TENN-F-55408).

tents multiguttulate. **Cheilocystidia** (Fig. 26) 30–48(-60) × (7-)9–15 µm (at widest point), usually significantly larger than basidia, clavate, broadly clavate to ventricose-rostrate, stalked (stalk 7–20 × 4–5.5 µm, obscurely clamped), often with adventitious apical outgrowths, thin- to firm-walled, hyaline; contents homogeneous; outgrowths usually two, stout and digitate, occasionally more complex. **Stipe medullary hyphae** strictly parallel, tightly packed, (2-)4–8 µm diam, firm- to thick-walled (wall ~0.5 µm thick), free (without slime matrix; not adherent in sheets), obscurely clamped, hyaline. **Stipe cortical hyphae** 4–8 µm diam, thick-walled [wall ~2 µm thick, weakly pigmented (PhC)], producing caulocystidia as side branches or hyphal termini. No stipe tissue dextrinoid. **Caulocystidia from upper stipe** (Fig. 25B) 20–250 × 4–10 µm, more or less equal, rounded at apex, thick-walled (wall ~1.5 µm thick, weakly pigmented near origin), often prominently clamped, occasionally branched, never straight, irregularly curved or kinked, in fascicles. **Caulocystidia from stipe base** (Fig. 27) 20–900 µm long, in two width ranges with intermediates: 1) 5–13 µm broad, predominant, thick-walled [wall ~2 µm thick, weakly pigmented (PhC)]; and 2) 12–21 µm broad, widely scattered in fascicles of 2–4 individuals, thick-walled (wall ~8 µm thick often occluding cell contents), distinctly pigmented.

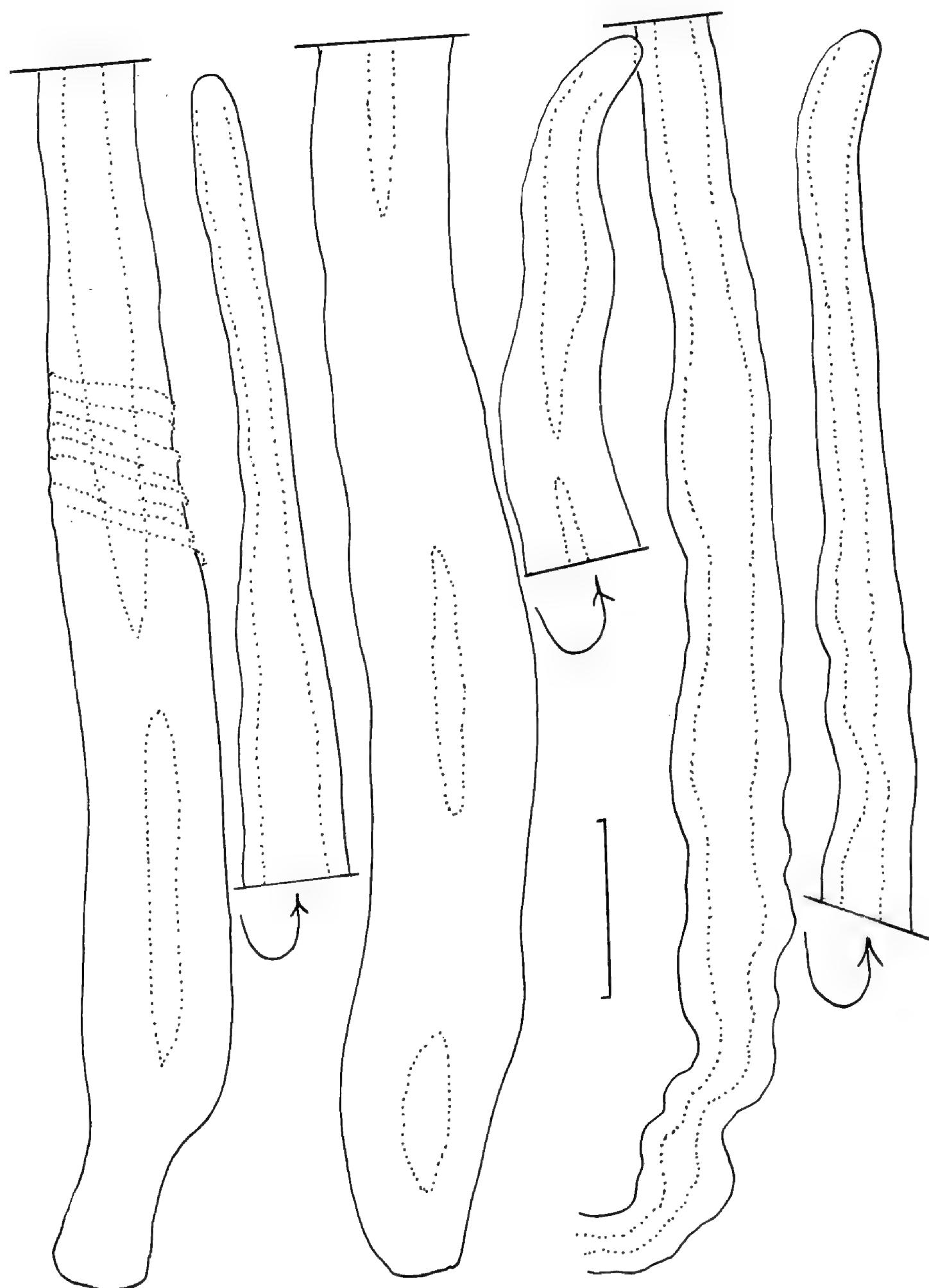


**Figure 25.** *Mycetinis copelandii*. **A** Basidiospores **B** Caulocystidia from upper stipe. Standard bars: **A** = 5  $\mu\text{m}$ ; **B** = 20  $\mu\text{m}$ . TFB 8084 (TENN-F-55408).



**Figure 26.** *Mycetinis copelandii*. Cheilocystidia. Standard bars = 10 µm. TFB 8084 (TENN-F-55408).

**Commentary.** The free-form cells of the pileipellis are reminiscent of those of members of *Gymnopus* (*Micromphale*) sect. *Perforantia* and (*Marasmius*) sect. *Androsacei* but are considerably more complex. The size of the lobes are like the broader lobes of some pileipellis lobes in the same groups.



**Figure 27.** *Mycetinis copelandii*. Caulocystidia from stipe base. Standard bar = 20  $\mu\text{m}$ . TFB 8084 (TENN-F- 55408).

Pleurocystidia are either absent or undifferentiated. Subjective judgement on their presence is based on: 1) ubiquitous presence in other taxa of *Mycetinis* and related groups; 2) narrow width as compared with immature basidia of more or less equal length; and 3) no evidence of distal heterogeneous contents, as opposed to developing basidia of more or less equal length.

When comparing *M. olidus* with *M. copelandii*, Desjardin (1987a) summarized macromorphological characters considered taxonomically important in *Marasmius* (e.g. macroscopic features, substrate, stipe attachment, and microchemical reactions) and concluded that the two were micromorphologically indistinguishable, but *M. olidus*, commonly collected in eastern North America, not only produced consistently smaller basidiomata on non-sclerophyllous leaves, but is allopatric with *M. copelandii*. Consequently, *M. olidus* is treated here at species rank.

Desjardin (1987b) considered *Marasmius copelandii* to be the most commonly collected alliaceous marasmoid fungus in California, fruiting in mixed coniferous/tan bark oak forests and oak woodlands along the California coast from San Diego County to Mendocino County, and in similar habitats in the foothills of the Sierra Nevada, Siskiyou and Trinity mountain ranges.

A single collection of putative *Ma. copelandii* (TENN55408-TFB 8084, based on spore dimensions) produced ITS sequences essentially congruent with those of *Ma. salalis* (1bp difference/722bp). This anachronism provokes the question of morphological discrepancies (in this case largely spore dimensions) versus molecular similarity. One solution is that *Ma. salalis*/*Ma. copelandii* produces long- and short-spored forms. A more accurate assessment will be possible when additional sequences become available and/or when multigene trees are produced.

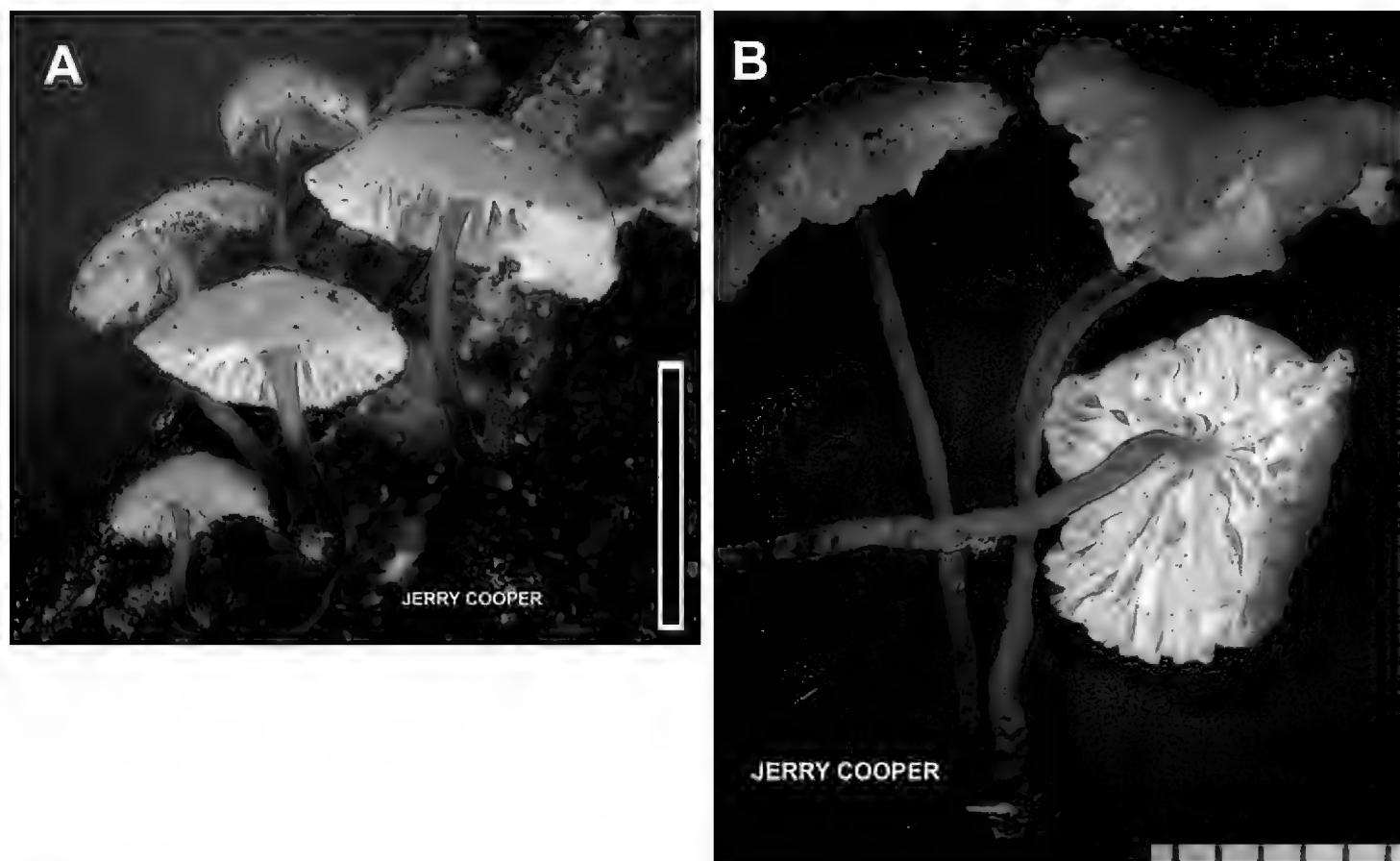
**Specimens examined.** California, Santa Cruz Co., Martin Rd., Fire Station, N37°03'03.6", W122°08'19.2", 13.XII.1983, coll. AS Methven (as *Marasmius siccus*), annot. D.E. Desjardin (as *Marasmius copelandii*) ASM 2676 (TENN57185); San Mateo Co., San McDonald County Pk., N37°18'31.7", W122°15'31.9", 12.XII.1983, coll AS Methven, annot. D.E. Desjardin (as *Marasmius copelandii*), TENN-F- 57189;

## 5. *Mycetinis curraniae* (G. Stev.) J. Cooper & P. Leonard in Cooper., 2012. Index Fungorum no. 3: 1.

**Basionym:** *Marasmius curraniae* G. Stevenson. 1964. Kew Bull 19(1): 39.

**Holotype.** New Zealand, North Island, Wellington, Butterfly, S41°00', E175°23', 11.III.1958, coll. M. Curran, Stevenson 1247 (K; annot. Desjardin; annot. Johnston).

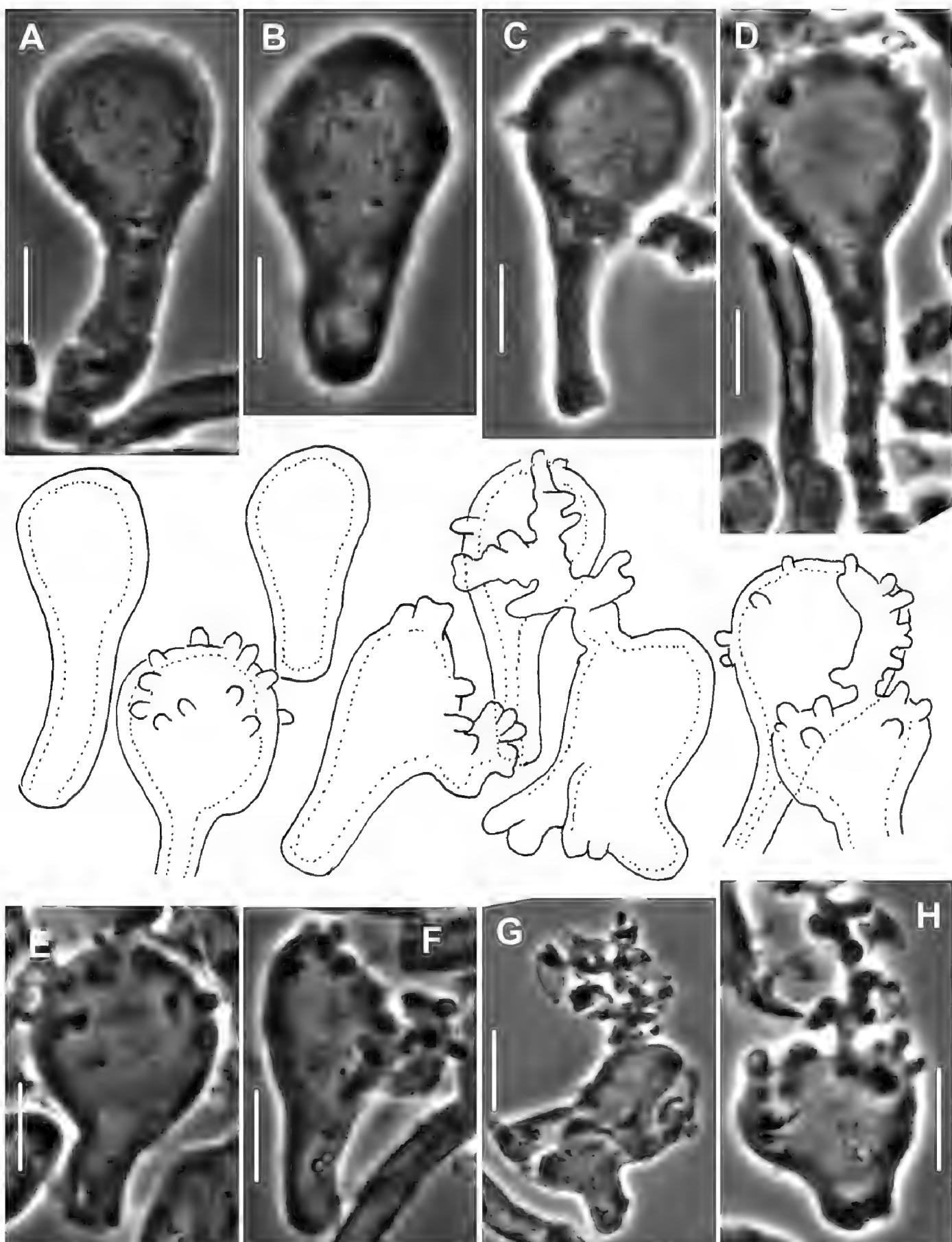
**Diagnosis.** 1) Basidiomata diminutive (pileus 5–16 mm broad; stipe 6–15 × 0.5–1 mm); 2) pileipellis a hymeniform layer of inflated hyphal termini, often with small knobs or coraloid outgrowths; 3) cheilocystidia similar to pileipellis cells, diverticulate; 4) spores 7–8 × 4–4.5 µm, ellipsoid, collybioid (not tapered proximally or distally); 5) fruiting on rotting bark and twigs of myrtaceous hosts; 6) distribution in New Zealand.



**Figure 28.** *Mycetinis curraniae*. Basidiomata. **A** PDD 86987 **B** PDD 95705. Standard bars: **A** = 10 mm. **B** Ruler in millimeters. Photo courtesy J. Cooper.

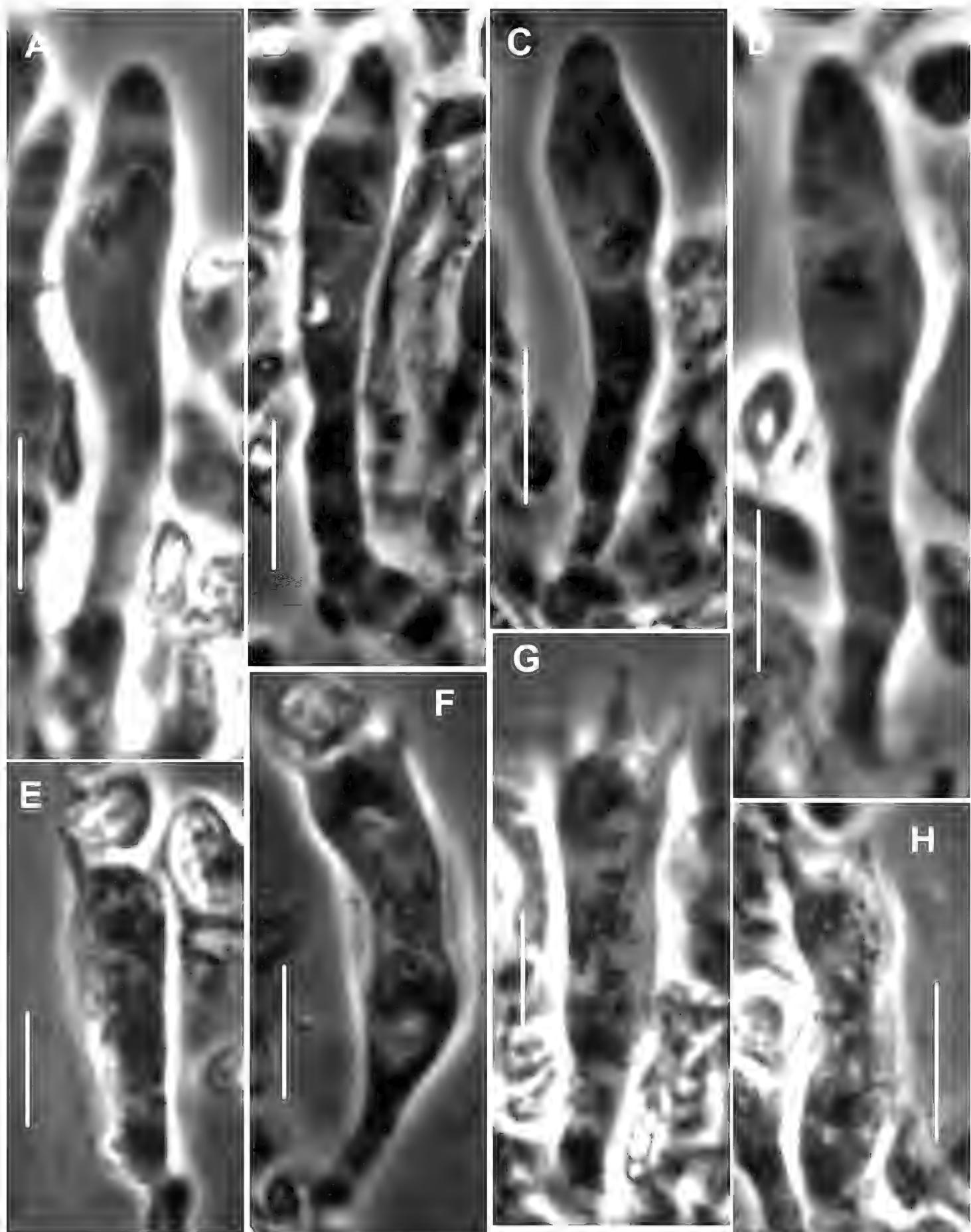
**Basidiomata** (Fig. 28) diminutive, solitary or in small clusters. **Pileus** 5–16(-20) mm broad, strongly convex when young, expanding in age to plano-convex sometimes with a slightly depressed disc, occasionally with low, broad umbo, shallowly subsulcate at the margin, pale beige-brown with reddish brown tones when young, disc remaining so in age, becoming paler toward the margin, dull, dry, minutely furfuraceous-punctate over disc. Subpellis hyphae interwoven, 3–6.5  $\mu\text{m}$  diam, firm-walled, apparently involved in a slime matrix; clamp connections sporadic, not universal. Pileus trama tough, supple when fresh, buff to pale concolorous with pileus surface; pileus tramal hyphae thin-walled to thick-walled, subgelatinous, inamyloid. **Lamellae** adnate to slightly decurrent, subdistant, often weakly pseudocolariate, total lamellae (23)-26–38, through lamellae 7–9, subventricose, up to 1.5 mm broad, rarely with buttresses, off-white to pale cream or pale beige, taking on slight pinkish tint upon drying and storage; lamellar edge minutely fimbriate, concolorous with lamellar face; lamellulae poorly developed, in two series. **Stipe** strongly curved to nearly straight, central or occasionally slightly eccentric, 6–15  $\times$  0.5–1.0 mm, terete, cylindrical, equal or slightly attenuate downward, tough, solid, insititious to expanded at base, appearing erumpent, apex minutely pulverulent, downward appearing glabrous to sparsely silky; stipe apex cinnamon, orange-brown to dark reddish brown, downward darker to almost black near base. **Rhizomorphs** not observed. **Odor** and **taste** strong, like garlic.

**Habitat and phenology.** Known only from New Zealand (both islands); solitary or in groups on rotting bark of twigs, living, standing trees and/or logs of myrtaceous



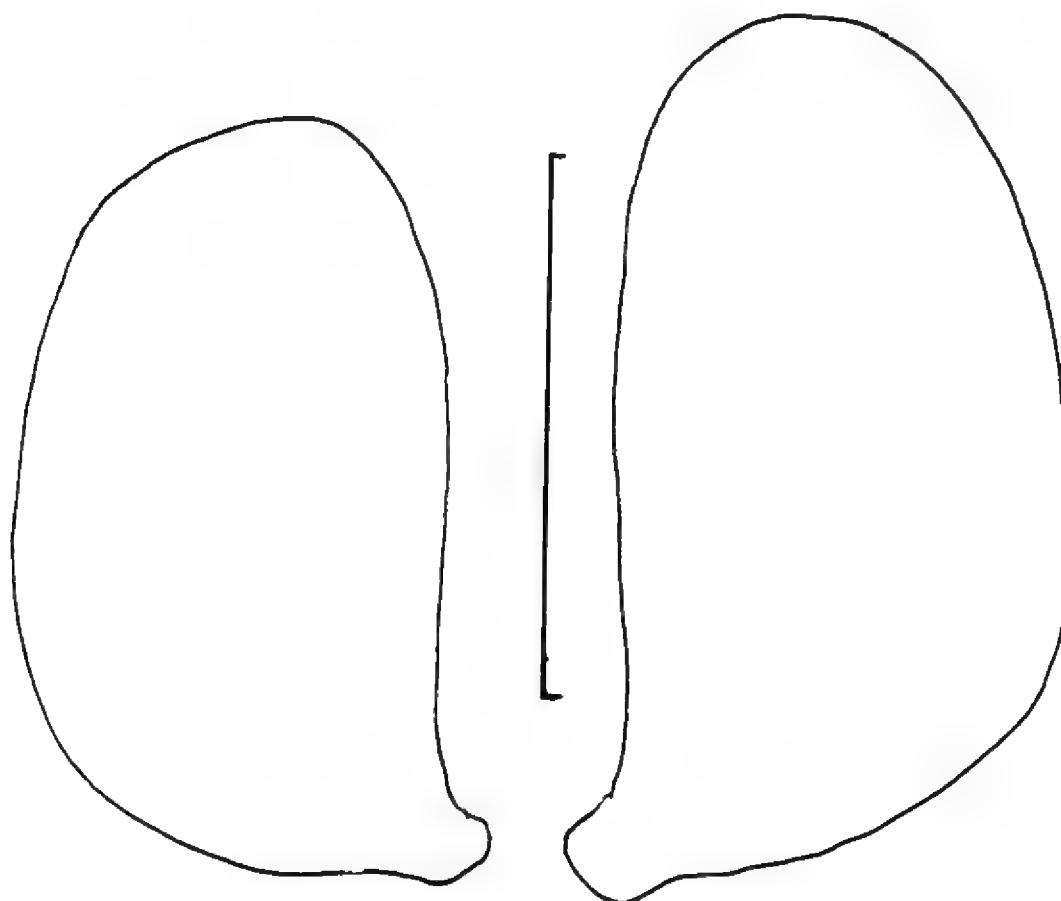
**Figure 29.** *Mycetinis curraniae*. Inflated pileipellis elements. **A, B** Structures minutely roughened but without papillate outgrowths **C, D** Structures with few, papillate outgrowths **E, F** Papillate outgrowths larger, more complex **G, H** Outgrowths complex, repeatedly rebranched. Line drawings represent photographs, not to scale. Standard bars = 10 µm. ZT 949 (SFSU).

trees (*Leptospermum* sensu lato, *Metrosideros umbellata*) (teste Horak). PDD reports nine collections from substrates *Kunzea ericoides*, *Dacrydium cupressinum* and *Cupressus macrocarpa*; mid-summer to autumn (Jan-May)



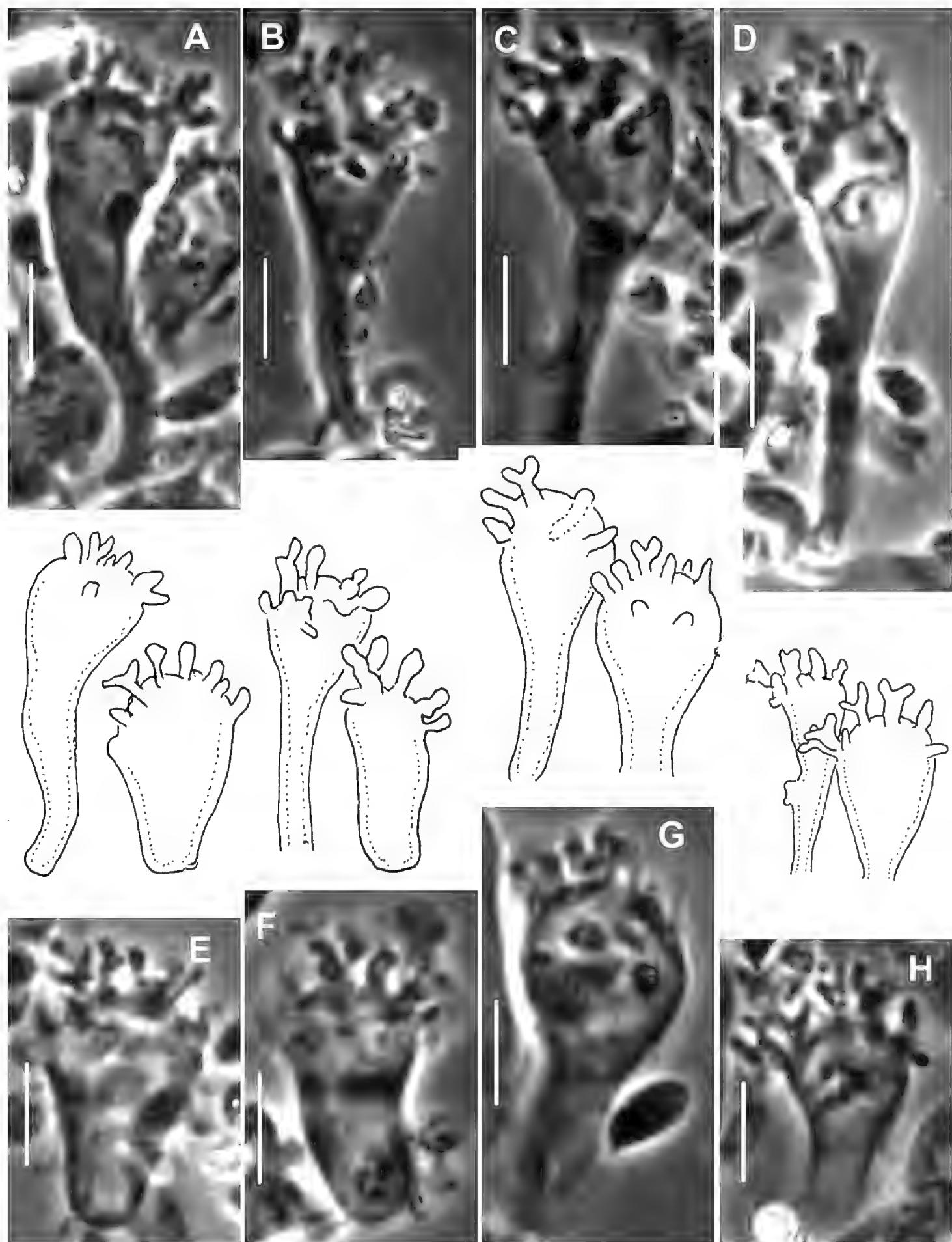
**Figure 30.** *Mycetinis curraniae*. Hymenial structures. **A–D** Pleurocystidia **E–H** Basidia. Standard bars = 10 µm. ZT 949 (SFSU).

**Pileus disc pileipellis** (Fig. 29) constructed of two elements: 1) repent hyphae 5–8.5 µm diam, firm- to thick-walled (wall ~1 µm thick, hyaline), coarsely encrusted, obscurely clamped; and 2) inflated hyphal termini 11–22 µm broad, in an interrupted layer, stalked (stalk 3–35 × 3–9 µm), thick-walled (wall 0.7–1.4 µm thick, hyaline



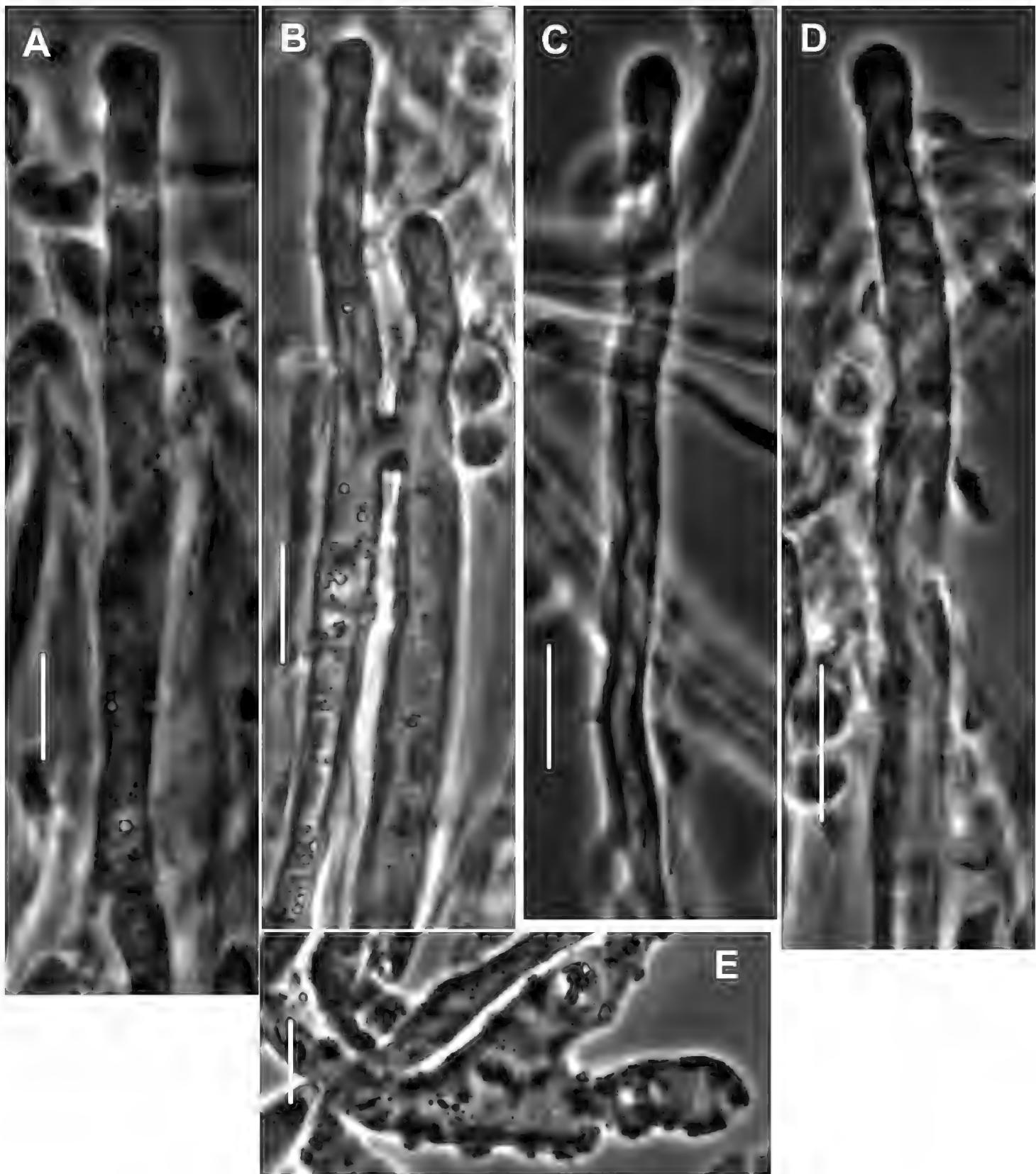
**Figure 31.** *Mycetinis curraniae*. Basidiospores. Standard bar = 5  $\mu\text{m}$ . ZT 949 (SFSU).

or occasionally weakly pigmented), usually very finely encrusted or roughened, either without outgrowths, with scattered papilla-like outgrowths (usually  $1-3 \times 1-1.5 \mu\text{m}$ , rounded), or with complex, branched, coraloid outgrowths  $4-20 \mu\text{m}$  long, with branches  $2-2.5 \mu\text{m}$  broad, repeatedly branched, flaccid. Underlying interwoven hyphae  $3-6.5 \mu\text{m}$  diam, firm-walled, apparently involved in a slime matrix; clamp connections sporadic, not universal. **Pleurocystidia** (Fig. 30A–D) plentiful,  $33-39 \times 4-7 \mu\text{m}$ , narrowly fusiform to fusiform, conspicuously clamped; contents more or less homogeneous. Basidioles clavate to (occasionally) subampulliform; **basidia** (Fig. 30E–H)  $24-35(-40) \times (4-)7-9 \mu\text{m}$ , clavate, (2-)4-sterigmate, obscurely clamped; sterigmata subcornute; contents heterogeneous, multiguttulate. **Basidiospores** (Fig. 31)  $(6.5-)7-8(-10) \times 4-4.5(-5) \mu\text{m}$  ( $Q = 1.50-2.00$ ;  $Q^m = 1.76$ ;  $L^m = 7.4 \mu\text{m}$ ), ellipsoid, flattened somewhat adaxially, smooth, thin-walled, inamyloid. **Cheilocystidia** (Fig. 32) locally common,  $27-40 \times 10-16 \mu\text{m}$  overall, stalked (stalk  $5-29 \times 4-9 \mu\text{m}$ , thick-walled), expanded distally to  $10-16 \mu\text{m}$  broad, surmounted by a cluster of diverticula; diverticula  $(1-)2-7 \times 1-1.5 \mu\text{m}$ , digitate, often dichotomous, hardly refringent. **Stipe medullary hyphae**  $(2-)5-11 \mu\text{m}$  diam, strictly parallel, free (not involved in a slime matrix), firm- to thick-walled (wall  $\sim 2 \mu\text{m}$  thick, hyaline, often fluctuating in thickness), conspicuously clamped. Stipe cortical hyphae  $4-14(-16) \mu\text{m}$  diam, thick-walled (wall  $\sim 2 \mu\text{m}$  thick, pigmented yellowish), producing two types of **caulocystidia** (Fig. 33); 1) widely scattered narrow-necked lobes,  $4-15 \times 4.5-7.5 \mu\text{m}$ , hyaline, firm- to thick-walled (wall  $\sim 1 \mu\text{m}$ ); and 2) repent caulocystidial hairs  $15->250 \times 4-7.5 \mu\text{m}$ , thick-walled (wall  $\sim 2 \mu\text{m}$  thick, hyaline to weakly yellowish), usually slightly subcapitulate apically, smooth to minutely roughened.



**Figure 32.** *Mycetinis curraniae*. Cheilocystidia. Line drawings represent photographs, not to scale. Standard bars = 10  $\mu\text{m}$ . ZT 949 (SFSU).

**Commentary.** *M. curraniae* produces diminutive basidiomata similar to those of *My. cinnamomeus*, *My. olidus*, *My. scorodonius* f. *diminutivus*, *My. virgultorum* and *My. yunnanensis*, usually fruiting in small clusters or troops on woody material. Steven-



**Figure 33.** *Mycetinis curraniae*. **A–D** Repent caulocystidia **E** Strongly encrusted pileipellis hypha. Standard bars = 10  $\mu\text{m}$ . ZT 949 (SFSU).

son's (1964) description reported features not observed subsequently, including weakly "pseudo-amylloid" (?dextrinoid) elements in pileus and lamellar tramae, pruinose stipe, "faintly amyloid" inflated pileipellis structures.

Pileipellis structures appear to be very finely roughened. This may be caused by a thin slime layer covering the pileipellis and certainly produced in the pileus trama as well. Pileipellis structures and cheilocystidia are not discretely defined and photos are difficult to interpret and depict. For this reason, line drawings are supplied to represent the structures in photos of these structures.

Desjardin and Horak (1997) drew attention to some similarities between *My. curraniae* and *M. cinnamomeus* Cleland (1934). Grgurinovic (1997) supplied a more detailed description of the latter, but by not citing a holotype, implied that a holotype (South Australia, National Park, Mt. Lofty, Willunga Hill, Innan Valley, teste Cleland) was unavailable. Desjardin and Horak (1997) concluded that *My. curraniae* and *M. cinnamomeus* were distinguishable at least as follows: 1) apparently no odor of garlic (noted as “odor none” by Cleland for *M. cinnamomeus*); 2) larger spores (9–12 × 4.5–6.0 µm teste Desjardin and Horak) of *M. cinnamomeus*; and 3) *M. cinnamomeus* fruiting on the base and bark of living *Eucalyptus*.

**Specimens examined.** New Zealand, North Island, Prov. North Auckland., Little Barrier Island, Tinkawa Stream, S36°11'56.60", E175°04'54.73", 14.V.1981, coll E. Horak, det. DE Desjardin [as *Marasmius curraniae* (sic)] Horak 949 (ZT, SFSU). New Zealand, South Island, Prov. Westland, Rotomantu, Lady Lake, S43°35'56", E171°34'41", 25.III.1983, coll E. Horak, det. DE Desjardin [as *Marasmius curraniae* (sic)] Horak 2101 (SFSU).

## 6. *Mycetinis kallioneus* (Huhtinen) Antonín & Noordel., 2008. Czech Mycol. 60: 26.

**Basionym:** *Marasmius kallioneus* Huhtinen. 1985. Mycol. Helvetica 1(5): 342.

**Holotype.** Denmark, Greenland, Frederikshåb, Paamiut, N62°00', W49°40', 24.IX.1983, 25 m, coll. T. Borgen, TB.83.83 (C).

**Diagnosis.** 1) Basidiomata small but robust (pileus 5–23 mm broad; stipe 20–40 × 1.5–2.0 mm); 2) pleurocystidia well-developed; 3) pileus dark brown; 4) spores 11–12 × 8–9 µm; 5) stipe vested, pruinose to pubescent; 6) boreal distribution (Greenland, Svalbard).

**Description.** **Basidiomata** (Fig. 34) small but robust. **Pileus** 5–23 mm broad, at first convex with inrolled margin, later plano-convex, more rarely somewhat depressed or papillate, hygrophanous, initially unicolorous and without striation, dark brown (Munsell 5YR4/3, “bone brown” 7F8), later disk brown (Cailleux P67; 7.5YR5/4, “Natal brown” 8E6) and margin lighter (M69; 7.5YR7/4, “olive brown” 5E5), crenulate, transient striate, matt to smooth to naked eye; context thin, supple, light gray brown. **Lamellae** adnate to shortly decurrent, distant, ventricose, thick, total lamellae (23-)33–35, through lamellae 7–9, up to 3 mm broad with occasional buttresses; lamellar edge smooth to minutely uneven, whitish overall or more rarely concolorous with pileus for ca 2 mm at the pileus margin, lamellae faces greyish pink (M53; 7.5YR7/2, “wood brown” 7C4), now (dried) “Dresden brown” 5E6 to “tawny olive” 5C3 on face, with “pale ochraceous buff” 4A2 to “light buff” 3A2 on edges. **Stipe** 20–40(-90) × 1.5–2.0 mm, central, dark reddish brown (T29; 5YR3/3, “bone brown” 7F8) to pink clay (ca 5YR6/4, “wood brown” 7C4) or café-au-lait (7.5YR5/2 X 4/2, “olive brown” 5E5 to “clove brown” 6F5), usually tapering somewhat distally, stuffed or partly hollow, not glabrous, ranging from pruinose to pubescent overall to apically pruinose with midsec-

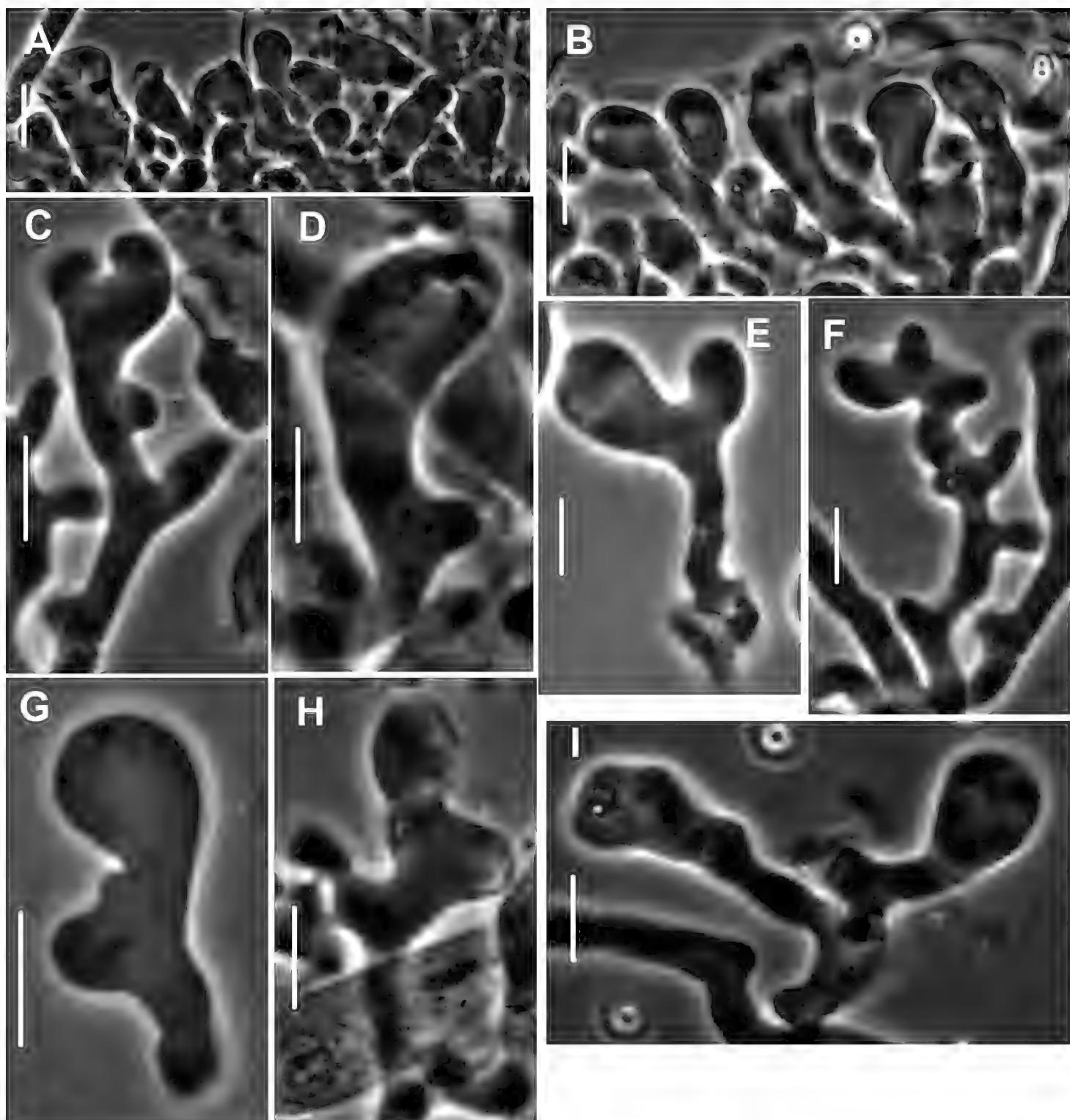


**Figure 34.** *Mycetinis kallioneus*. Basidiomata. Photo courtesy Ellen Larsson. ELS 57-17C. Standard bar = 20 mm.

tion smooth (?through handling) and lower stipe pubescent; lower stipe (1-5 mm from base) minutely wooly or lannose, stipe base consistently appressed-pilose, now (dried) “olive buff” 3B3 (perhaps paler when fresh). **Odor** strongly alliaceous, devoid of fetid components; **taste** similar, moderate to strong.

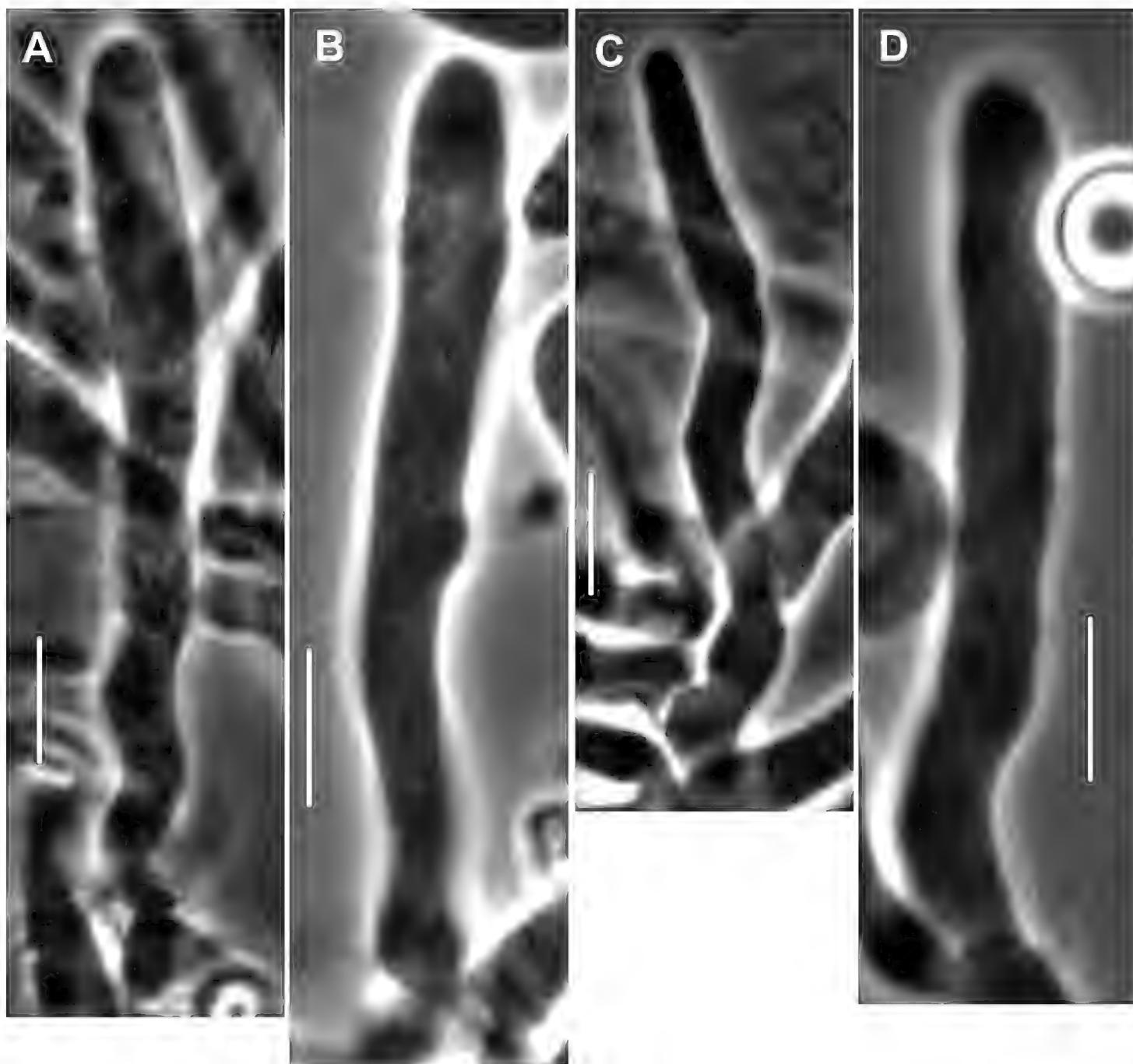
**Habitat and phenology.** Presently known from Greenland and Svalbard; collected in “dwarf scrub heathland” and in snow-bank communities, often with stipe disappearing among polytrichous moss; associated woody plants include *Salix herbacea*, *Vaccinium uliginosum* and *Betula nana* and non-woody taxa including *Cerastium*, *Empetrum*, *Taraxacum*, *Silene*, *Dryas*, *Oxyria*, *Stellaria* and *Carex*; reported from late July through September.

**Pileipellis** (Fig. 35) over pileus margin an irregular hymeniform monolayer of inflated elements, on pileus disc more interrupted and in age becoming commonly collapsed; inflated elements 17–60 × 7–18 µm, ranging from broadly clavate, mitten-shaped to coarsely lobate, usually stalked [stalk 4–35 × 3.5–5 µm, occasionally thick-walled (wall-1.5 µm thick, occasionally pigmented yellow-olive PhC)], conspicuously clamped; inflated portion 8–25 × 7–18 µm, firm-walled, smooth, not with papillate outgrowths, neither amyloid nor dextrinoid. Subtending hyphae tightly interwoven, 3–5.5 µm diam, firm-walled, hyaline, conspicuously clamped. Pileus trama loosely



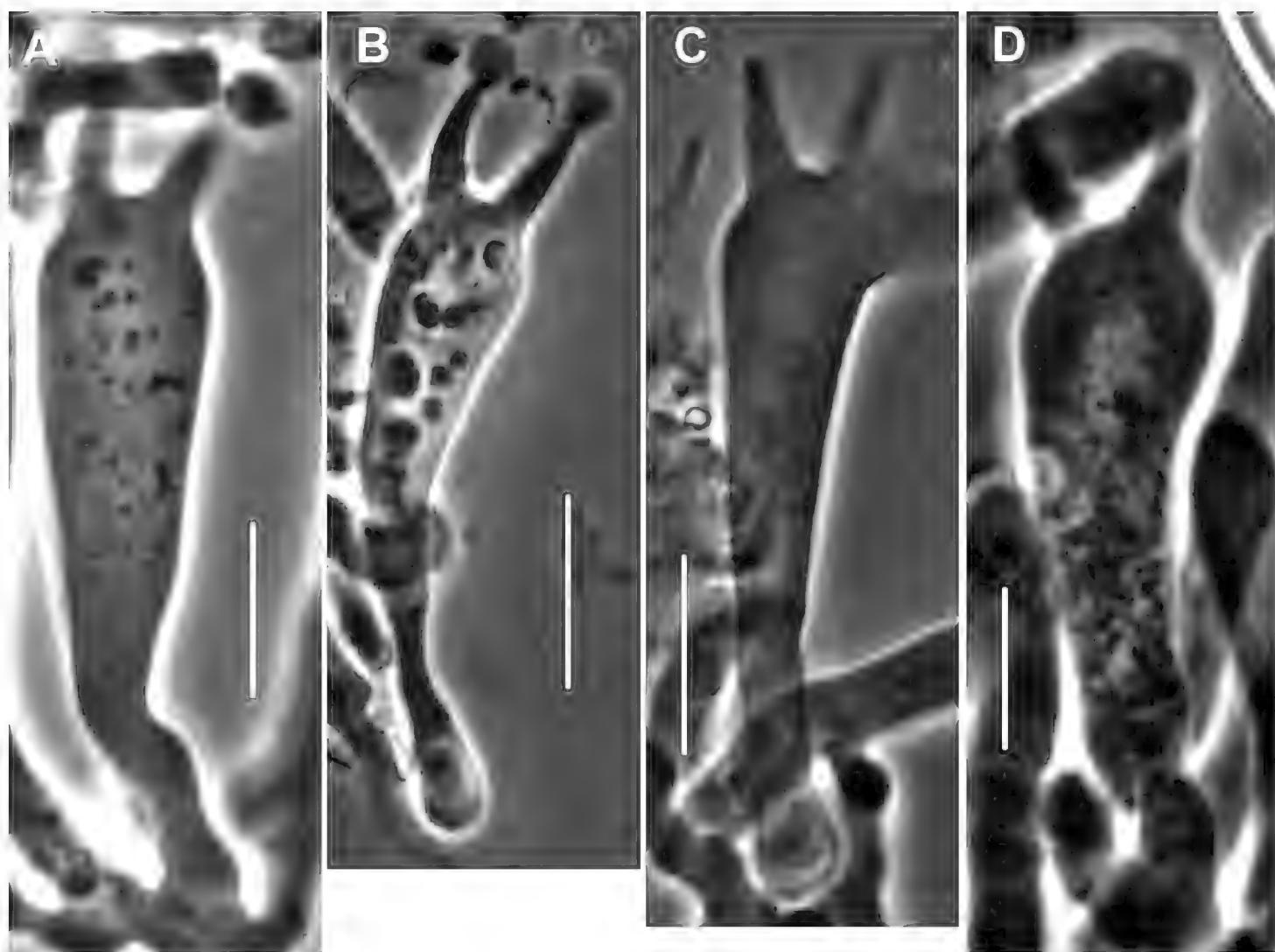
**Figure 35.** *Mycetinis kallioneus*. Pileipellis structures. **A, B** Overview of irregular hymeniform layer **C–I** Individual pileipellis elements. Standard bars = 10 µm. TB 85-209 (TUR).

interwoven; hyphae 3–6.5(-8) µm diam, thin- to thick-walled (wall -0.5 µm thick), hyaline, conspicuously clamped, free (i.e. not involved in a slime or gelatinous matrix); “vascular hyphae” common, meandering through pileus and lamellar tramae, 2.5–4 µm diam, with dense, cyanophilous contents, refringent (BF). Hymenophoral trama regular-subregular, in dried material rather dark brown (30×); hyphae firm- to thick-walled (walls -0.8 µm thick), inamyloid, non-dextrinoid, conspicuously clamped. **Pleurocystidia** (Fig. 36) plentiful, 35–62 × 6–7 µm overall (at widest point), narrowly digitate, narrowly fusiform, usually projecting beyond basidia; base 3.5–5 µm diam, conspicuously clamped. Basidioles clavate to subcapitulate; **basidia** (Fig. 37) 34–55(-



**Figure 36.** *Mycetinis kallioneus*. Pleurocystidia. Standard bars = 10  $\mu\text{m}$ . TB 85-209 (TUR).

65)  $\times$  (7-)10–12  $\mu\text{m}$ , clavate, obscurely clamped, exclusively 2-sterigmate; sterigmata 9  $\times$  2–2.5  $\mu\text{m}$  (stout, subcornute); contents heterogeneous, multigranular. **Basidiospores** (Fig. 40B) (9-)11–12(-13)  $\times$  (7-)8–9(-9.5)  $\mu\text{m}$  ( $Q = 1.18$ –1.63;  $Q^m = 1.35$ ;  $L^m = 11.3 \mu\text{m}$ ), amygdaliform (low hump on abaxial surface, often sublimoniform distally), smooth, thin-walled, inamyloid; contents sometimes uniguttulate. **Cheilocystidia** (Fig. 38) plentiful on lamellar edge but not rendering the edge sterile, 25–50  $\times$  12–17  $\mu\text{m}$  overall, stalked (stalk 7–35  $\times$  3–4  $\mu\text{m}$ , conspicuously clamped, firm-walled), distal portion expanded to broadly clavate, 10–14  $\mu\text{m}$  broad, occasionally bifurcate with lobes rounded, rarely irregularly complex-lobate. **Stipe medullary hyphae** free (not involved in slime matrix), conspicuously clamped, of three types: 1) 7–14  $\mu\text{m}$  diam, thin-walled; contents heterogeneous; 2) 2–5.5, thin-walled, contents homogeneous; and 3) “vascular hyphae” 3–6.5  $\mu\text{m}$  diam, refringent (PhC), cyanophilous. Stipe cortical hyphae filamentous, 2.5–5.5  $\mu\text{m}$  diam, thin- to firm-walled, tightly packed,



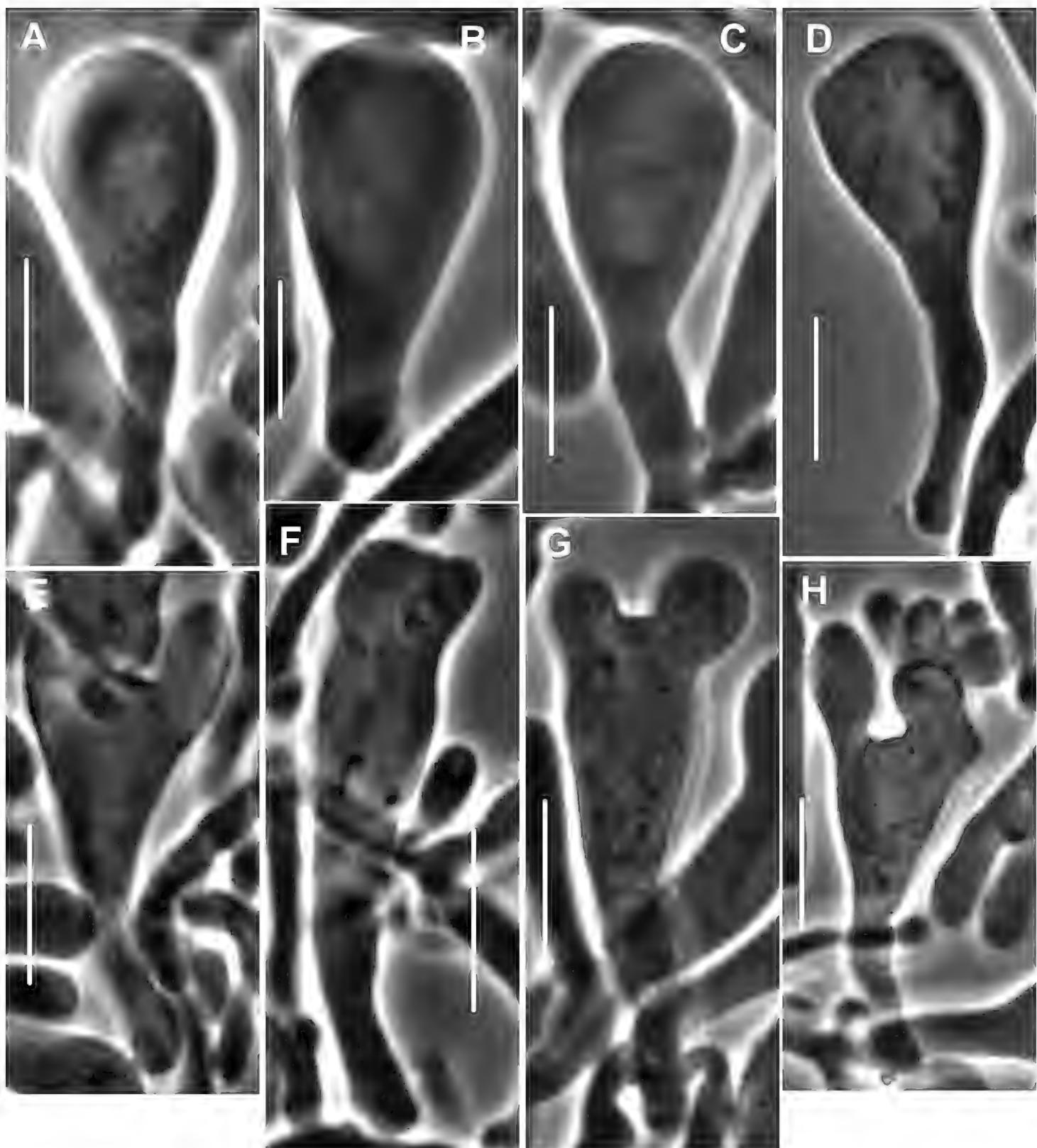
**Figure 37.** *Mycetinis kallioneus*. Basidia. Standard bars = 10  $\mu\text{m}$ . TB 85-209 (TUR).

strictly parallel, weakly pigmented, producing side branches. **Caulocystidia from stipe apex** (Fig. 39) cheilocystidial, gathered in clusters, stalked; stalk  $5-16 \times 3-4 \mu\text{m}$ , conspicuously clamped, distally expanded into broadly clavate to lobate shapes,  $9-12 \mu\text{m}$  broad, firm-walled. **Caulocystidia from lower stipe** (Fig. 40A) filamentous,  $10-150 \times 3.5-5.5 \mu\text{m}$ , firm- to thick-walled (wall  $0.7 \mu\text{m}$  thick, hyaline), arising as side branches of stipe cortical hyphae, bluntly rounded apically, rarely straight, usually bent or gnarled, without internal clamp connections.

**Commentary.** For a discussion of pleurocystidial identification see Materials and Methods under taxonomic characters.

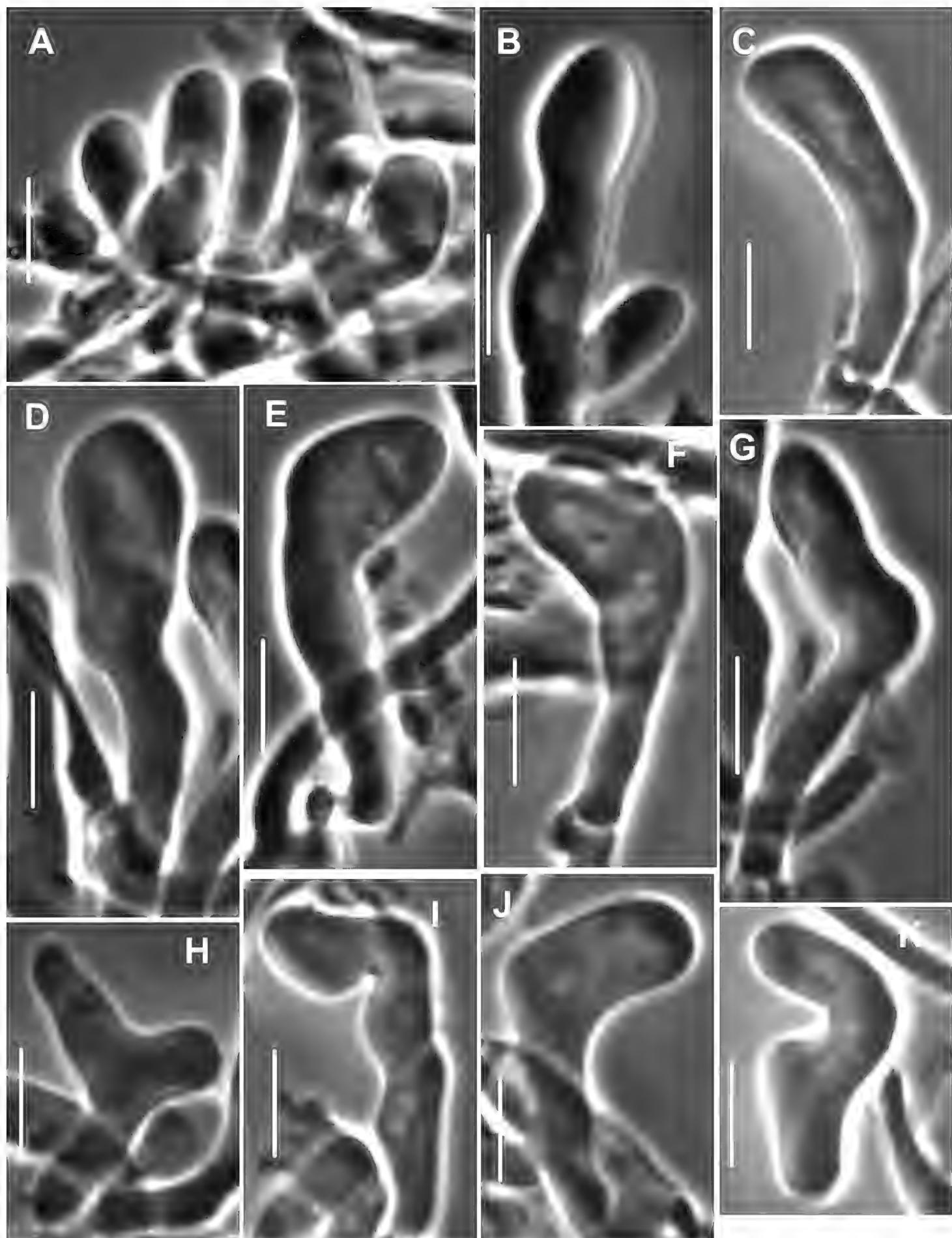
Identification of cheilocystidia is based on two points: 1) experience with other taxa in *Mycetinis* and other marasmoid and micromphaliod has shown such relatively rudimentary cheilocystidial structures, although some species of *Mycetinis* exhibit broom cell-like cheilocystidia; and 2) cheilocystidial structures described and illustrated here are limited to lamellar edge and are of greater diameter than basidia and are ventricose-rostrate, not gradually clavate as basidia.

The small pustules of cheilocystidoid caulocystidia at the stipe apex seem unique in the genus. The structures themselves are not surprising, because such resemblance is found in phylogenetically widely separated fleshy fungi (i.e. *Strobilomyces*, *Hymenopellis*).



**Figure 38.** *Mycetinis kallioneus*. Cheilocystidia. Standard bars = 10 µm. TB 85-209 (TUR).

**Specimens examined.** **Denmark**, Greenland, Frederikshåb, Paamiut, N62°00', W49°40', 19.viii.1985, coll. T. Borgen, TB.85.209 (TUR 040959, topotype). **Norway**, Svalbard, Longyearbyen, mouth of Blomsterdalen, N78°14', E15°30', 5.VIII.1983, coll. S. Huhtinen (as *Marasmius* sp.), SH 83/267 (TUR 079363); same location, 31.VII.1983, coll & det S. Huhtinen, SH 83/141 (TUR 079364); Isfjorden, west side of Grønfjorden, Kongressdalen, middle part, N78°02', E14°07', 19.VIII.1966, coll. Esteri Kankainen (as *Marasmius* sp.), s.n. (TUR 079366); Vestspitsbergen, Kongsfjorden, southeast of Ny Ålesund, N78°55', E12°02', 24.VIII.1966, leg E. Kankainen, s.n. (TUR 072364).



**Figure 39.** *Mycetinis kallioneus*. Caulocystidia from stipe apex. **A** Cluster of caulocystidia **B–K** Individual caulocystidia. Standard bars = 10  $\mu\text{m}$ . TB 85-209 (TUR).



**Figure 40.** *Mycetinis kallioneus*. **A** Caulocystidia from lower stipe surface **B** Basidiospores. Standard bars: **A** = 20  $\mu\text{m}$ ; **B** = 5  $\mu\text{m}$ . TB 85-209 (TUR).

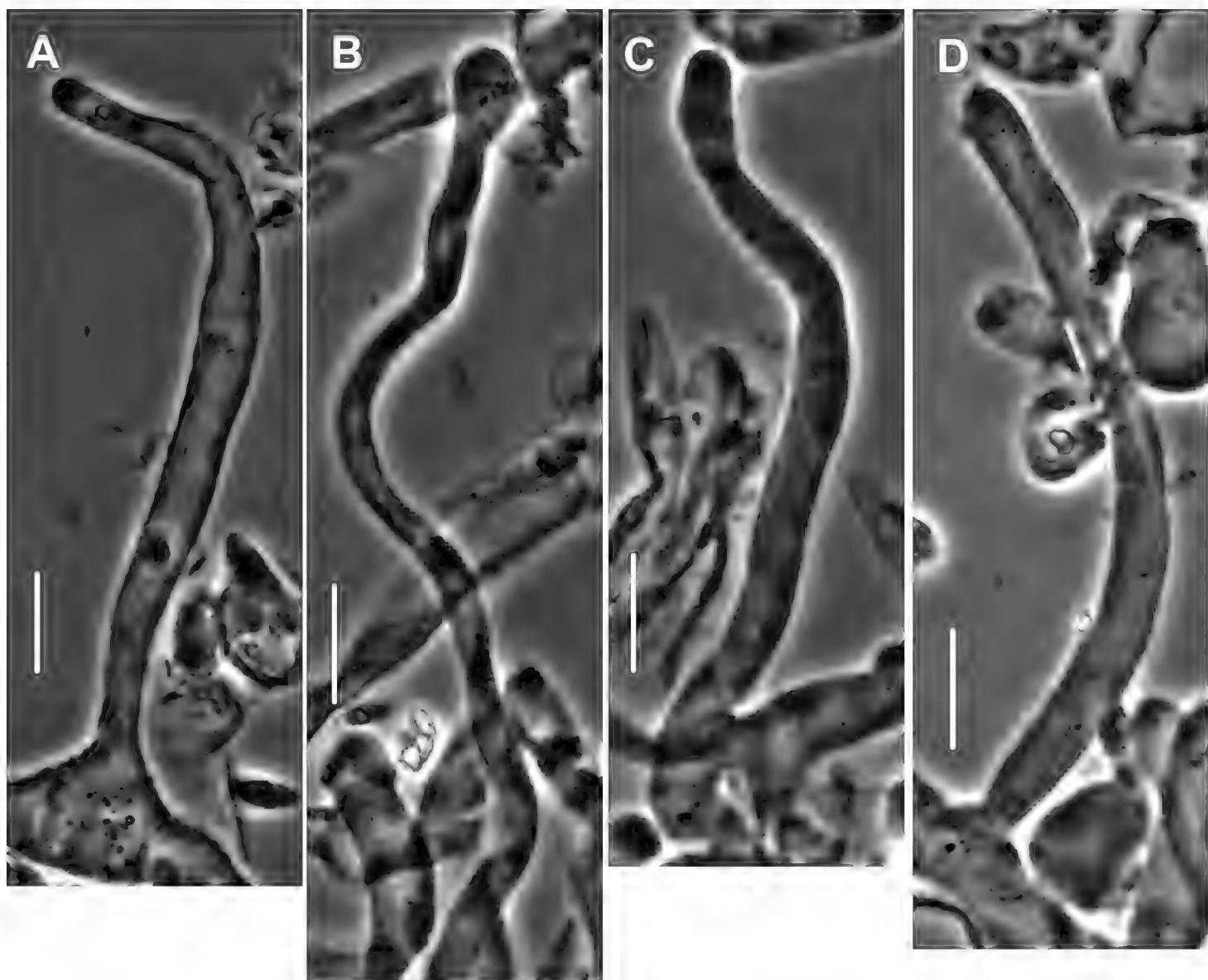
**7. *Mycetinis olidus* (Gilliam) R.H. Petersen, comb. nov.**

Index Fungorum no. 553204

**Basionym:** *Marasmius olidus* Gilliam 1975. *Mycologia* 67: 822.

≡ *Marasmius copelandii* var. *olidus* (Gilliam) Desjardin 1987a. *Mycologia* 79: 129.

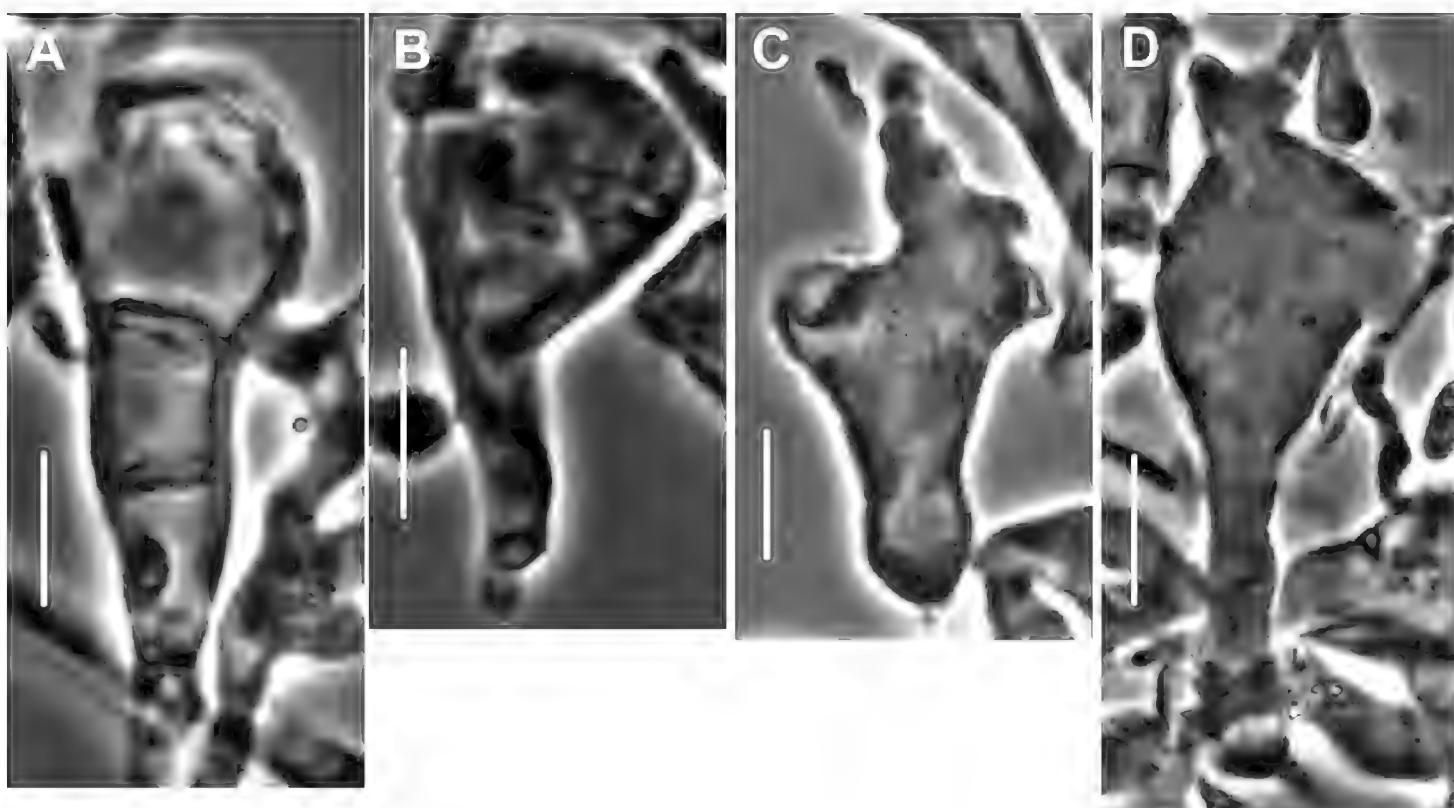
**Holotype.** United States, Michigan, Oakland Co., Proud Lake [N42°33'42", W83°31'43"], 1.XI.1970, coll W.W. Patrick, Gilliam 997, (MICH).



**Figure 41.** *Mycetinis olidus*. Pileal hairs. Standard bars = 10  $\mu\text{m}$ . MG 1973 (MICH-F- 0051239).

**Diagnosis.** 1) Basidiomata diminutive (pileus 3–18 mm broad; stipe 12–31  $\times$  0.4–2.1 mm; 2) vested, grayish brown stipe; 3) curved-clavate spores 10–16  $\mu\text{m}$  long; 3) fruiting habitat on fallen *Pinus* needles and *Quercus* leaves; 4) penetrating odor of garlic; 5) distribution in eastern United States from Michigan to Tennessee and North Carolina, south to central Florida.

**Pileus** 3–18 mm broad, pulvinate or convex at first, then plano-convex and often umbilicate, finally plane or convex with a wavy margin, dry, dull, opaque or matt, minutely velutinous particularly on the disc; margin entire to sulcate-striate nearly to disc, pliant, reviving; disc moderate brown in primordia, soon light yellowish brown (Maerz & Paul 11D4-5), “grayish olive” 30C3 outward “pale olive buff” 3B2, often tinged pink, or moderate brown on the disc and light yellowish brown elsewhere. **Pileus trama** thin (-1.5 mm thick), firm, yellowish white. **Lamellae** distant, adnexed or subdecurrent, narrow (0.6–1.5 mm broad), thin, distant, moderately numerous (through lamellae 15–20), unequal, with 2–3 irregular tiers of lamellulae, sometimes seceding in age, membranous, often subventricose, entire or minutely fimbriate, straight, occasionally somewhat intervenose, rarely forked near the stipe, light yellowish brown (M&P 11B4) to “tilleul buff” 7B2, in drying becoming concolorous with mature pilei to distinctly “cinnamon” 6B5 or avellaneous (?necropigment). **Stipe** 12–31(-35) mm

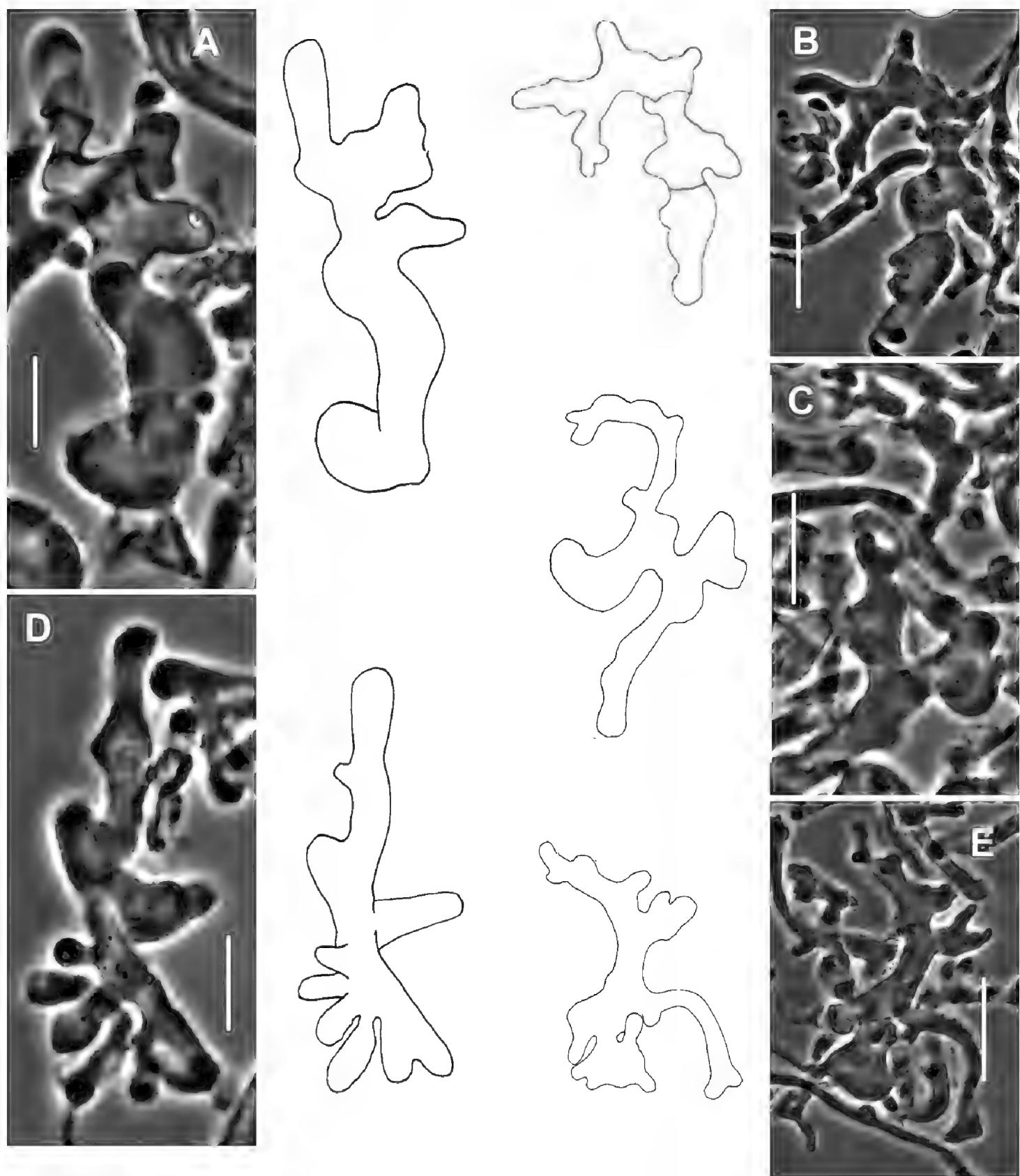


**Figure 42.** *Mycetinis olidus*. Inflated pileipellis structures. Standard bars = 10  $\mu\text{m}$ . DED 4529 (TENN 57177).

long, 0.5–2.1 mm thick, central, terete or flattened at the apex, tapered slightly to the base, straight or curved, dry, dull, opaque, hollow, cartilaginous, even, pruinose above, tomentose below, concolorous with lamellae, yellowish white or light yellowish brown up to 2 mm from the apex downward, moderate brown, grayish brown tinged pink, “wood brown” 7C4 to “buffy brown” 6D4 or blackish brown below; not insititious; vesture whitish at stipe apex, downward brownish pink. **Sterile stipes** occasionally present along the leaf veins near basidiomata, tapered, glabrous, yellowish brown. **Rhizomorphs** lacking or rare, extremely slender (0.1–0.3 mm broad), -8 mm long, curly, unbranched, black. Basal mycelium on hardwood leaves sometimes forming a flat disc, often visible near the leaf veins as well, fine, resembling spun glass, white. **Odor** weakly pleasant to pungent, of garlic or onion, often persisting in drying and storage.

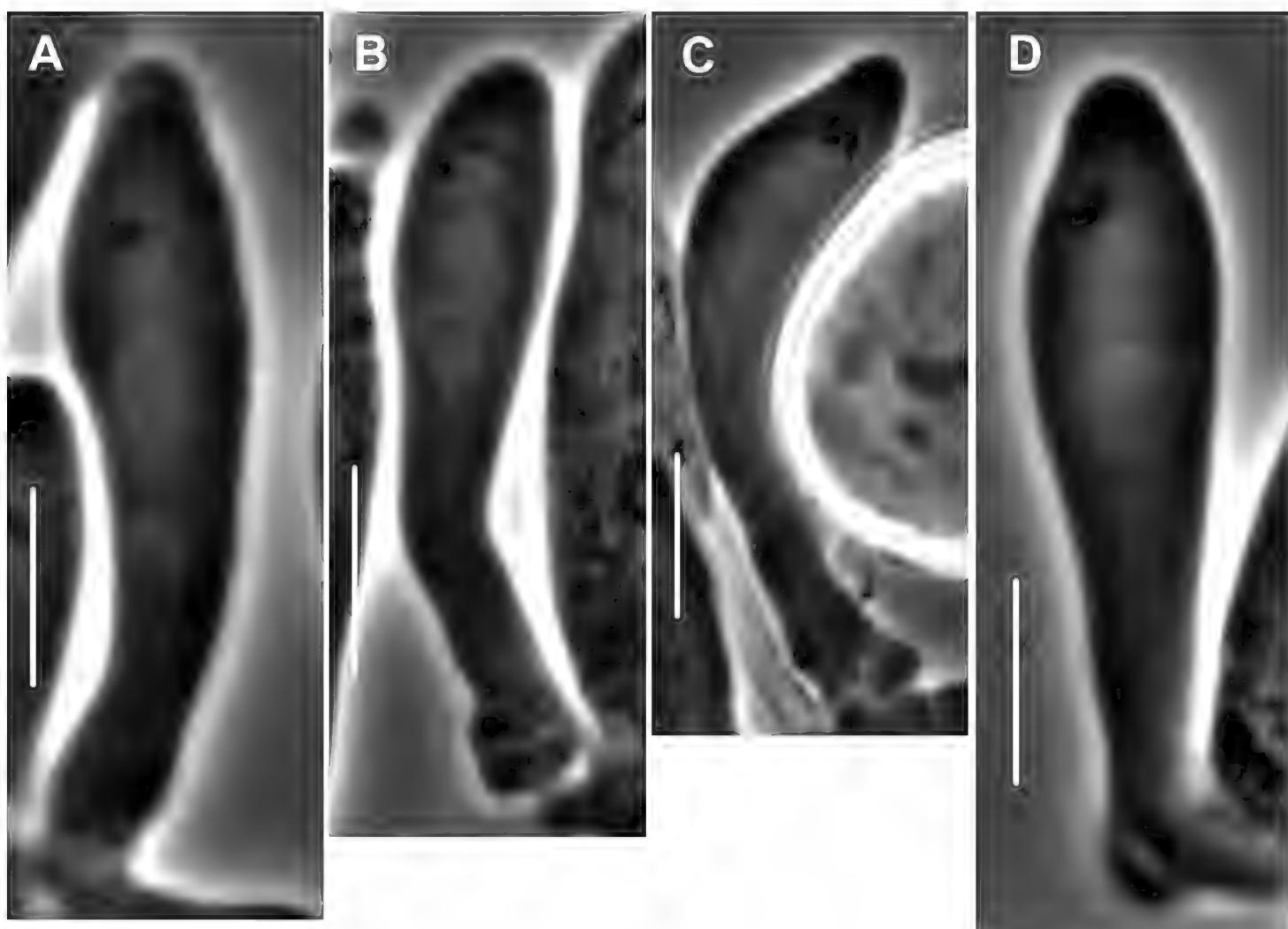
**Habitat and phenology.** Gregarious on duff of *Pinus strobus* and *P. resinosa* and on midribs of hardwood leaves, usually *Quercus* ( teste Gilliam 1975); eastern North America from Ontario/Quebec south to Gulf Coast; May to November.

**Pileipellis** constructed of three interlocking types of structures: 1) pileal hairs (Fig.41) as side-branches of repent pileipellis,  $75 \times 4$ – $8$ ( $-14$ )  $\mu\text{m}$ , thin- to firm-walled, minutely roughened (perhaps resinous), usually subcapitulate; 2) inflated hyphal termini (Fig. 42) broadly clavate, subglobose, to spheropedunculate,  $(9)$ – $20$ – $36$ ( $-42$ )  $\times$   $(4)$ – $11$ – $21$ – $24$   $\mu\text{m}$ , usually thick-walled (wall  $1.0 \mu\text{m}$  thick, occasionally weakly pigmented), occasionally with lobose apical outgrowths; and 3) free-form hyphal segments (Fig. 43), often quite extensive, firm-walled, with lobes and extended arms, occasionally internally septate, sometimes with internal clamp connections. Pileus and lamellar tramae loosely interwoven; hyphae  $3$ – $7.5$  diam, thin-walled, occasionally clamped.



**Figure 43.** *Mycetinis olidus*. Free-form pileipellis structures. Outlines furnished to better interpret photographs. Standard bars = 10  $\mu\text{m}$ . DED 4529 (TENN 57177).

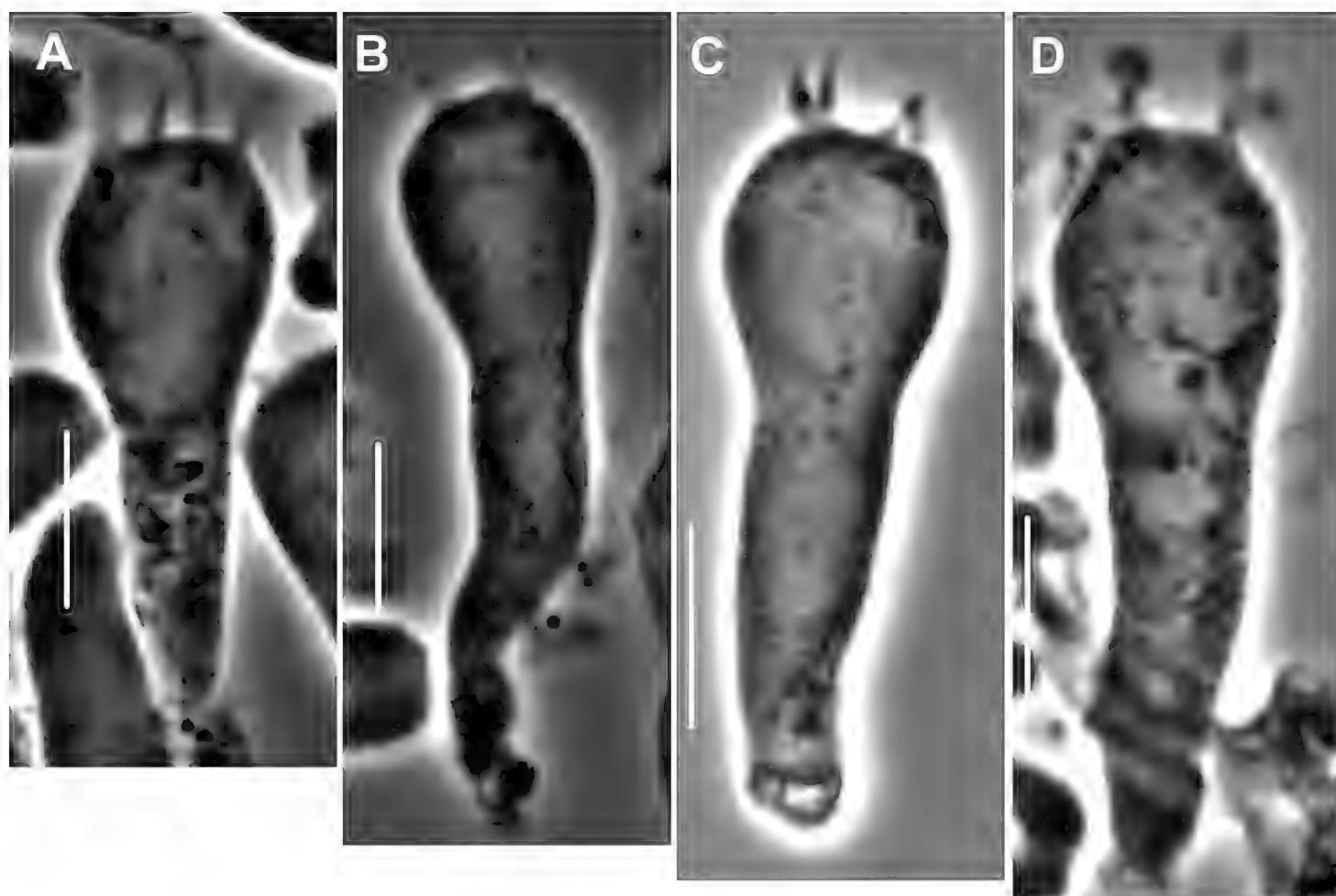
**Pleurocystidia** (Fig. 44) 14–32  $\times$  6.5–8.5  $\mu\text{m}$ , generally fusiform with rounded apex, conspicuously clamped; contents more or less homogeneous. **Basidia** (Fig. 45) 19–26(-29)  $\times$  (4-)7–10  $\mu\text{m}$ , clavate, hardly capitulate, 4-sterigmate, obscurely clamped; contents heterogeneous, multiguttulate; sterigmata slender, spindly. **Basidiospores** (Fig. 49A) (8-)11–16  $\times$  (2.8-)3.5–4(-4.5)  $\mu\text{m}$  ( $Q = 2.00–3.67$ ;  $Q^m = 2.93$ ;  $L^m = 11.7 \mu\text{m}$ ), marasmoid (distally rounded, proximally tapered), thin-walled, inamyloid; contents minutely granular. **Cheilocystidia** (Figs 46, 47) rare to plentiful, occasionally probably rendering lamel-



**Figure 44.** *Mycetinis olidus*. Pleurocystidial structures. Standard bars = 10 µm. VA 97 257 (TENN 50012).

lar edge sterile, 28–45 × 10–16 µm (at widest point), stalked (stalk 5–30 × 3.5–5 µm, obscurely clamped), expanded distally, ranging in shape from obpyriform, to obpyriform with one or more large lobes or digitate diverticula, hyaline, thin- to firm-walled; contents more or less homogeneous. **Stipe medullary hyphae** 3–9 µm diam, strictly parallel, nonamyloid, thin-walled. **Stipe cortical hyphae** 2–8.5 µm diam, nonamyloid, thick-walled (wall ~2 µm thick, pigmented pale yellow to moderate reddish brown, immediately weakly yellow-olive in 3% KOH (BF). **Caulocystidia** (Figs 48, 49B) -150 × 2.5–8.5 µm, arising as side branches or termini of stipe surface hyphae, thick-walled (wall ~2.5 µm thick, hyaline to moderate brown, light olive green in KOH), scattered on stipe apex, downward more densely gregarious, toward stipe base gathering into synemmatoid columns of ~150 individuals, appearing hirsute; stipe base strigose.

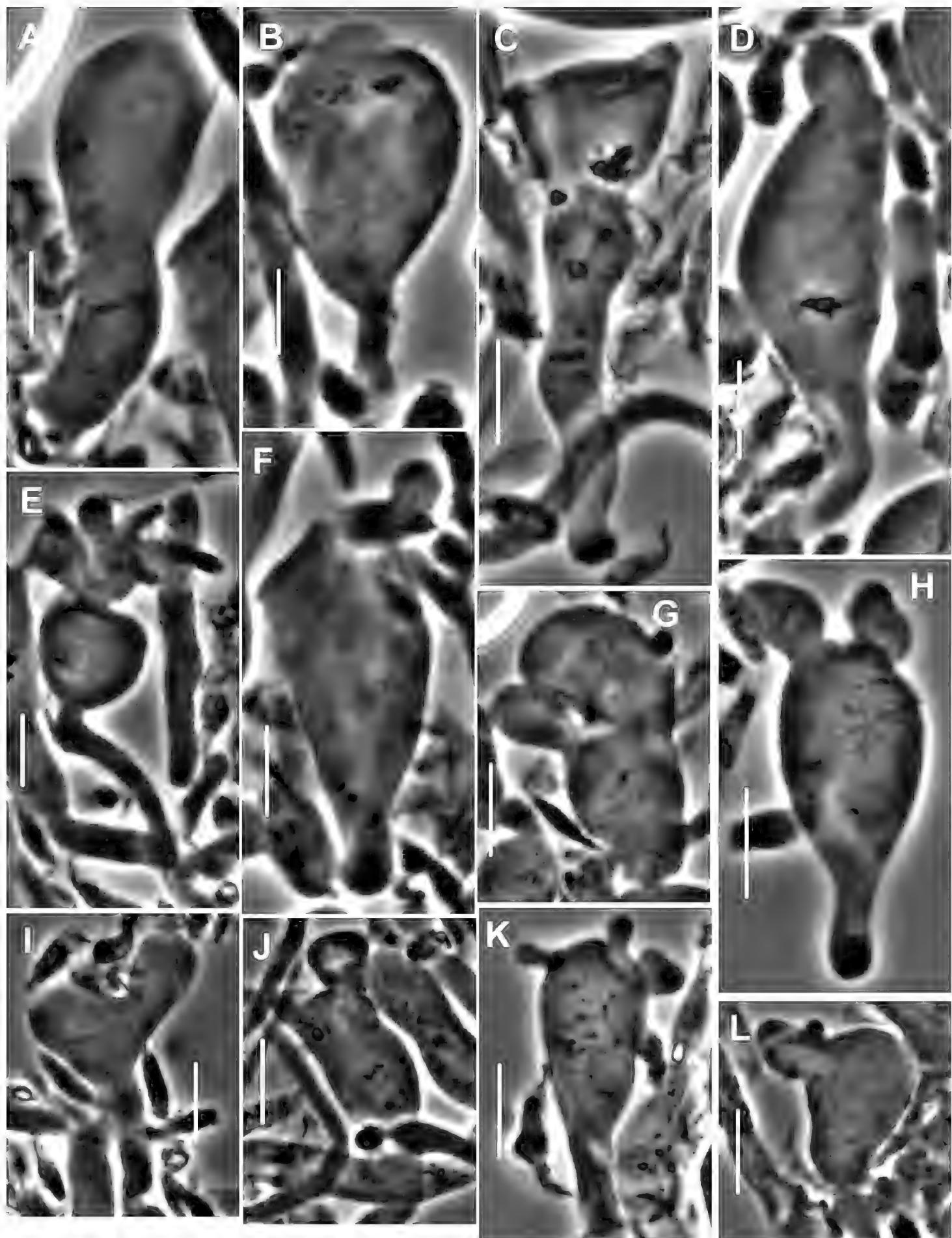
**Commentary.** Interpretation of structures and terminology can be summarized as follows. 1. Gilliam (1975b) chose not to use the term cheilocystidia for clavate cells found “present on the lamellar edges only,” and not projecting beyond basidia. Such cells are scattered along the lamellar edge, sometimes indistinguishable from immature basidia except for cell breadth (10–16 µm broad for clavate cells versus 8–10 µm broad for basidia). Usually, however, frequent cheilocystidial cells form lobes or diverticula, immediately distinguishing them from basidioles. 2. Pleurocystidia are either absent or indistinguishable from basidioles before the latter have developed heterogeneous contents and clavate shape. For similar conclusions, see under *My. copelandii*. 3. Other east-



**Figure 45.** *Mycetinis olidus*. Basidia. Note heterogeneous contents. Standard bars = 10 µm. DED 4529 (TENN 57177).

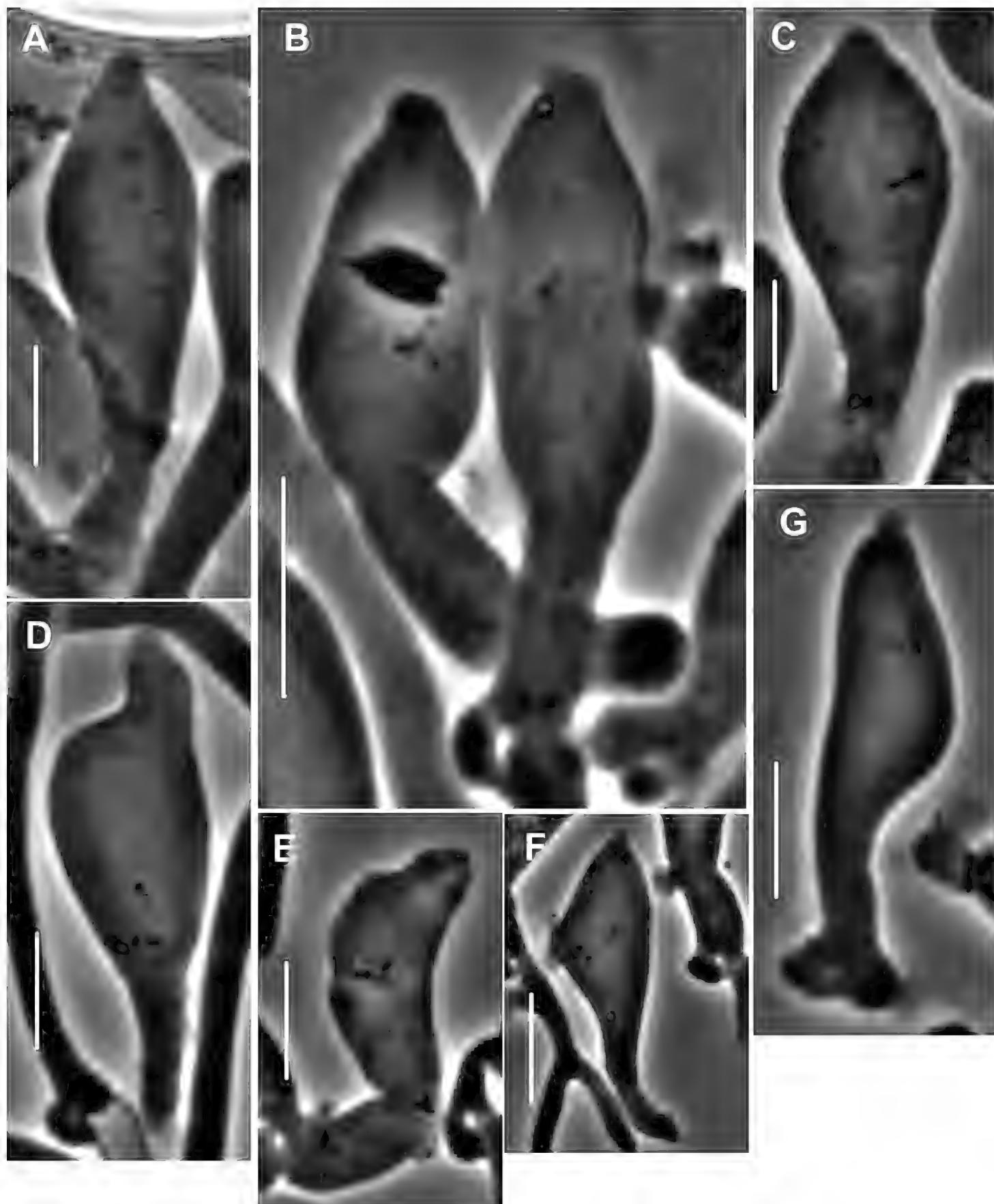
ern North American taxa on *Quercus* leaves = *Gymnopus* (sect. *Perforantia*) *foliophilus*, *G. inflatotrama* nom. prov., *G. novomundi* nom. prov. (*Androsacei*) and *M. straminipes*. 4. “Sterile stipes” (teste Gilliam 1975) are reminiscent of *M. opacus*, in which sterile stipes are common but interpreted as rhizomorphs (Desjardin et al. 1993). 5. Caulocystidial wall thickness is not visible in PhC, but with IKI and BF, the inner surface of the wall becomes visible because the hyper-refringency of the caulocystidia disappears.

Desjardin (1989) provided type specimen descriptions of *Marasmius copelandii* Peck and *M. olidus* Gilliam. Desjardin (1987a) concluded that the differences between *M. olidus* and *M. copelandii* did not warrant species rank, and reduced Gilliam’s epithet as *M. copelandii* var. *olidus*. According to Index Fungorum, Gilliam’s epithet (as *Marasmius olidus* or *M. copelandii* var. *olidus*) has not been transferred to *Mycetinis*. Here, the differences from *My. copelandii* appear significant enough to accept *My. olidus* as a separate species within *Mycetinis*. The two taxa share the following: 1) strong odor and taste of garlic; 2) vested stipe; 3) spore statistics; 4) doubtfully differentiated pleurocystidia; 5) basically clavate cheilocystidia; 6) inflated pileipellis elements. Differences between *My. olidus* and *My. copelandii* can be listed as follows: 1) basidiomata of *My. olidus* consistently smaller and less robust than those of *My. copelandii*; 2) pileipellis free-form cells appear to be of different shape and extent; 3) lamellae distant (*My. olidus*) versus close to crowded; 4) cheilocystidia are doubtful in *My. olidus*, but when observed, they range from those figured by Gilliam to broadly fusiform and submammilate; 5) fruiting habitat on *Quercus* leaves; 5) distribution in eastern North America.



**Figure 46.** *Mycetinis olidus*. Clavate cells from lamella edge. Standard bars = 10  $\mu\text{m}$ . DED 4529 (TENN 57177).

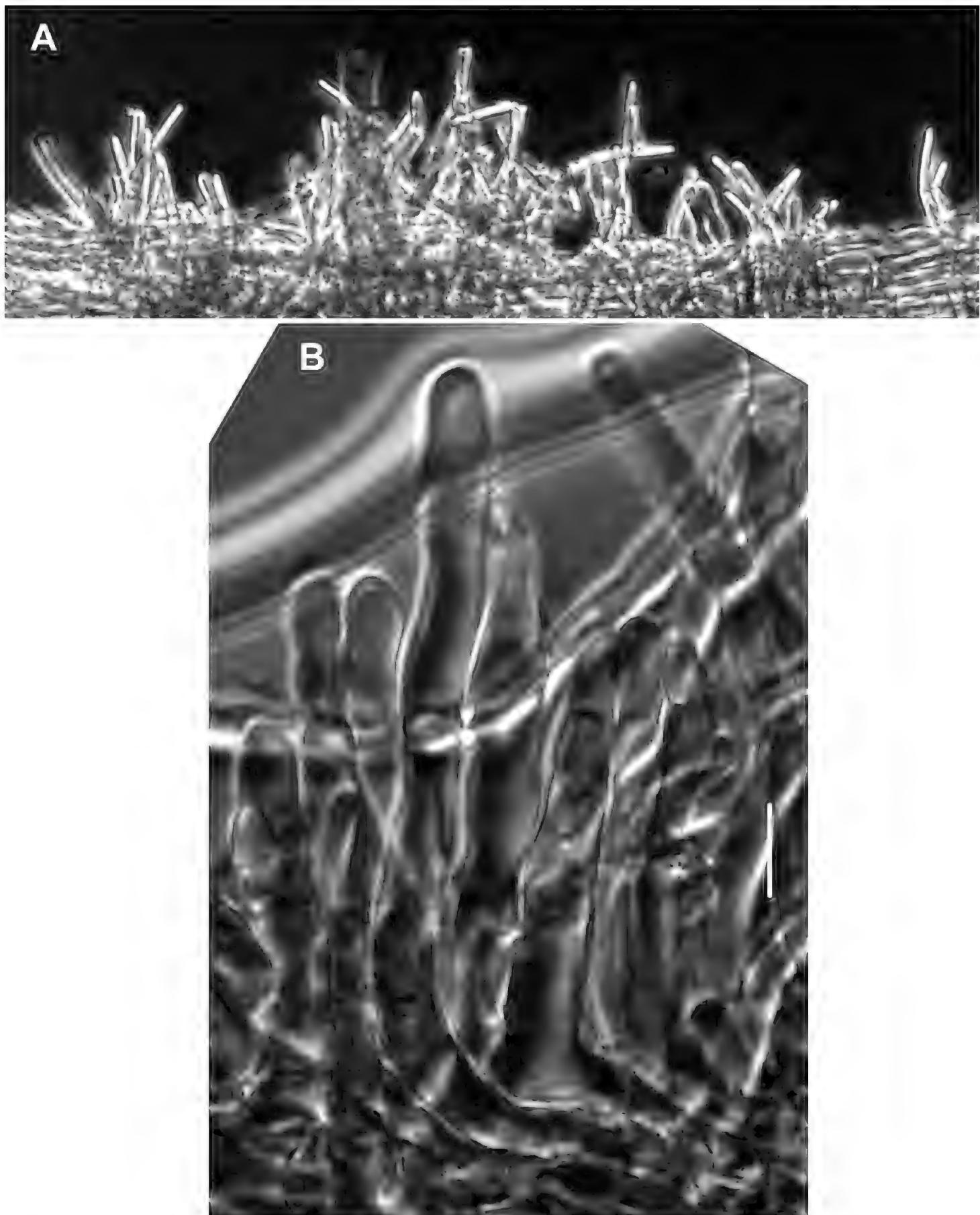
Alexander Smith's preliminary identification of MICH-F-005239 (paratype of *My. olidus*) as *M. prasiosmus* may have been predicated on habitat (i.e. on fallen *Quercus* leaves) and advice from his professor, Calvin Kauffman. Here, *My. prasiosmus* (= *My.*



**Figure 47.** *Mycetinis olidus*. Cheilocystidia. Standard bars = 10  $\mu\text{m}$ . MG 1973 (MICH-F-0051239).

(*quercus*) is accepted in *Mycetinis*, but for an apparent European taxon, basidiomata of which are significantly larger than those of *My. olidus*, and the micromorphology of which is quite different from that of *My. olidus*, especially spore size and shape.

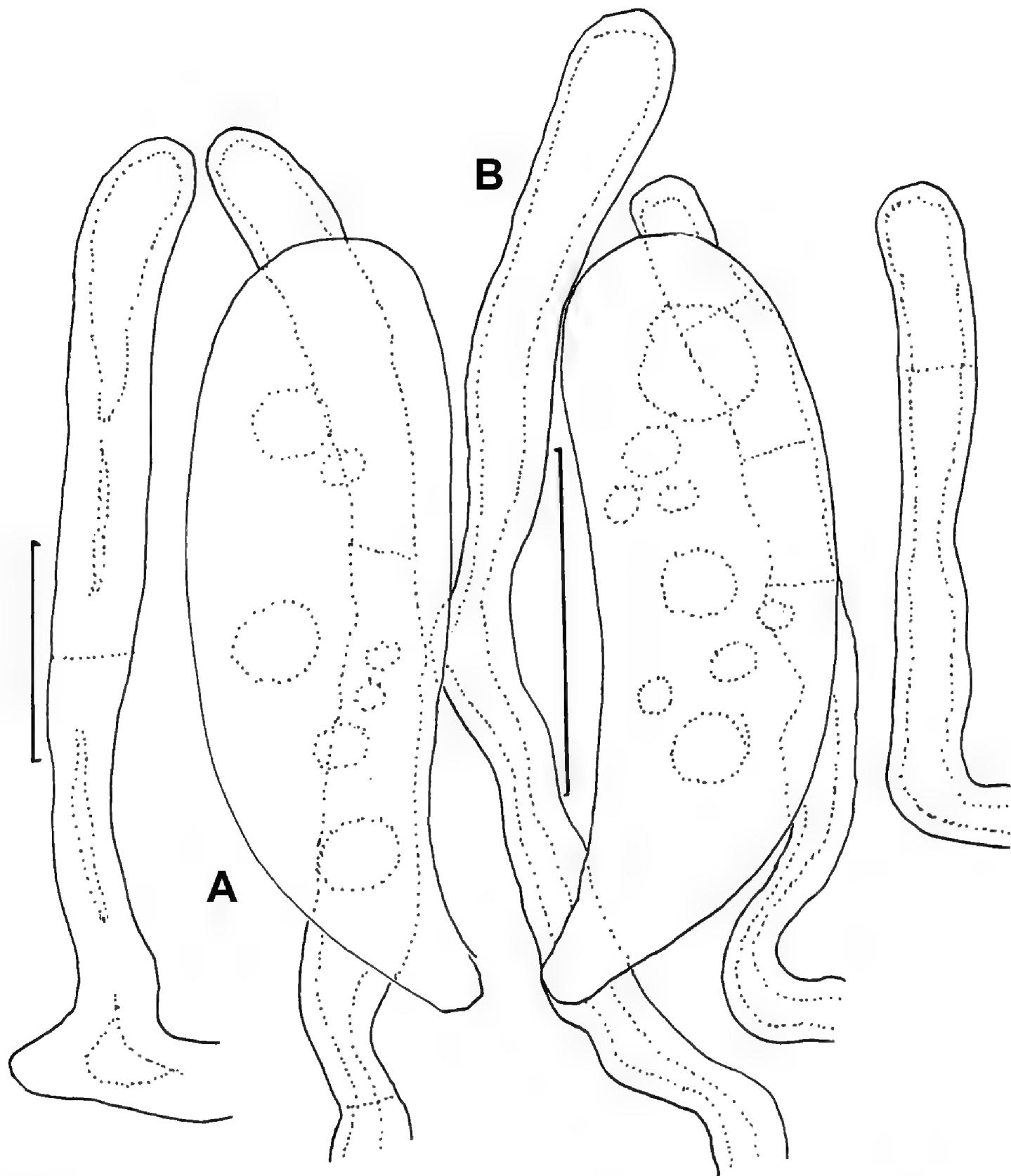
Redhead (1982) correctly reported that “pigmented hyphal walls” of stipe cortex of *My. olidus* (as *Marasmius*) showed a color change to greenish gray in KOH solution. This reaction was also reported for *M. prasiosmus*, but this is true only for Kauffman’s concept of this name, for which *M. olidus* was later introduced. The American concept



**Figure 48.** *Mycetinis olidus*. Caulocystidial structures. **A** Arrangement of caulocystidia on stipe surface **B** Caulocystidia. **A** = not to scale. **B** Standard bar = 10  $\mu\text{m}$ . VA 97 257 (TENN 50012).

of *M. prasiosmus* is quite different from the European organism treated here as *M. prasiosmus*, in which the color reaction is missing.

**Specimens examined.** United States, Florida, Alachua Co., vic. Gainesville, San Felasco State Park, Planera Hammock, Hwy 232, N29°47'00.2", W82°27'58.0", 12.XII.1987, coll DE Desjardin, TFB DED 4529 (TENN57177). Michigan, Liv-



**Figure 49.** *Mycetinis olidus*. Caulocystidia and basidiospores. **A** Basidiospores (DED 4529) **B** Caulocystidia (VA 97 257). Standard bars: **A** = 5  $\mu\text{m}$ ; **B** = 20  $\mu\text{m}$ . VA 97 257 (TENN 50012).

ingston Co., vic. Pinckney, E.S. George Reserve, N42°27'30.88", W84°00'41.34", 4.X.1936. coll. A.H. Smith (AHS5034, as *M. prasiosmus*), det. M. Gilliam (as *M. olidus*) (MICH-F-00051235, paratype); Oakland Co., Proud Lake, N42°33'42", W83°31'43", 1.XI.1970, coll W.W. Patrick, Gilliam 997, (MICH-F-11400, holotype, p.p.); Proud Lake, N42°33'42", W83°31'43", 15.X.1955, coll. AH Smith (AHS51125) (as *Marasmius prasiosmus*), det. M. Gilliam (as *M. olidus*) (MICH-F- 0051239; paratype); Milford, 15.IX.1938, N42°35'32", W83°36'05", coll. A.H. Smith (AHS10936,

as *M. prasiosmus*), det. M Gilliam (as *M. olidus*) (MICH-F-0051237, paratype); Haven Hill, N42°38'27.56", W83°33'48.28", 11.X.1956, coll. A.H. Smith (AHS62192, as *M. prasiosmus*), det. M. Gilliam (as *M. olidus*) (MICH-F- 00051238, paratype); Washtenaw Co., Ann Arbor, N42°16', W83°44', Cascade Glen, 17.IX.1907, coll. & det. C.H. Kauffman (as *M. prasiosmus*), s.n. (MICH-F-00051241); vic. Chelsea, Mill Lake, N42°19'44", W84°05'22", 26.VIII.1972, coll. A.H. Smith (s.n., as *M. prasiosmus*), det. M. Gilliam (as *M. olidus*, MG 1549 (MICH-F- 0051243, paratype); vic. Dexter, Silver Lake, N42°25'13", W83°57'35", 2.X.1936, coll. A.H. Smith (AHS5004, as *M. prasiosmus*), det. M. Gilliam (as *M. olidus*) (MICH-F- 00051244, paratype); vic. Dover, Silver Lake, N42°25'13", W83°57'35", 23.IX.1938, coll. A.H. Smith, (AHS11057, as *M. prasiosmus* ss. Kauffman), det. M. Gilliam (as *M. olidus*) (MICH-F-0051245; paratype). **North Carolina**, Swain Co., GSMNP, Kephart Prong Trail, N35°35'23.7", W83°21'49.2", 25.VII.1991, coll V Antonin, VA 97/257 (BRNM; fragment TENN50012); **Tennessee**, Blount Co., GSMNP, Metcalf's Bottoms, N38°40'54.1", W83°38'56.7", 24.V.2013, coll. Sam Morris, TFB 14211 (TENN68071).

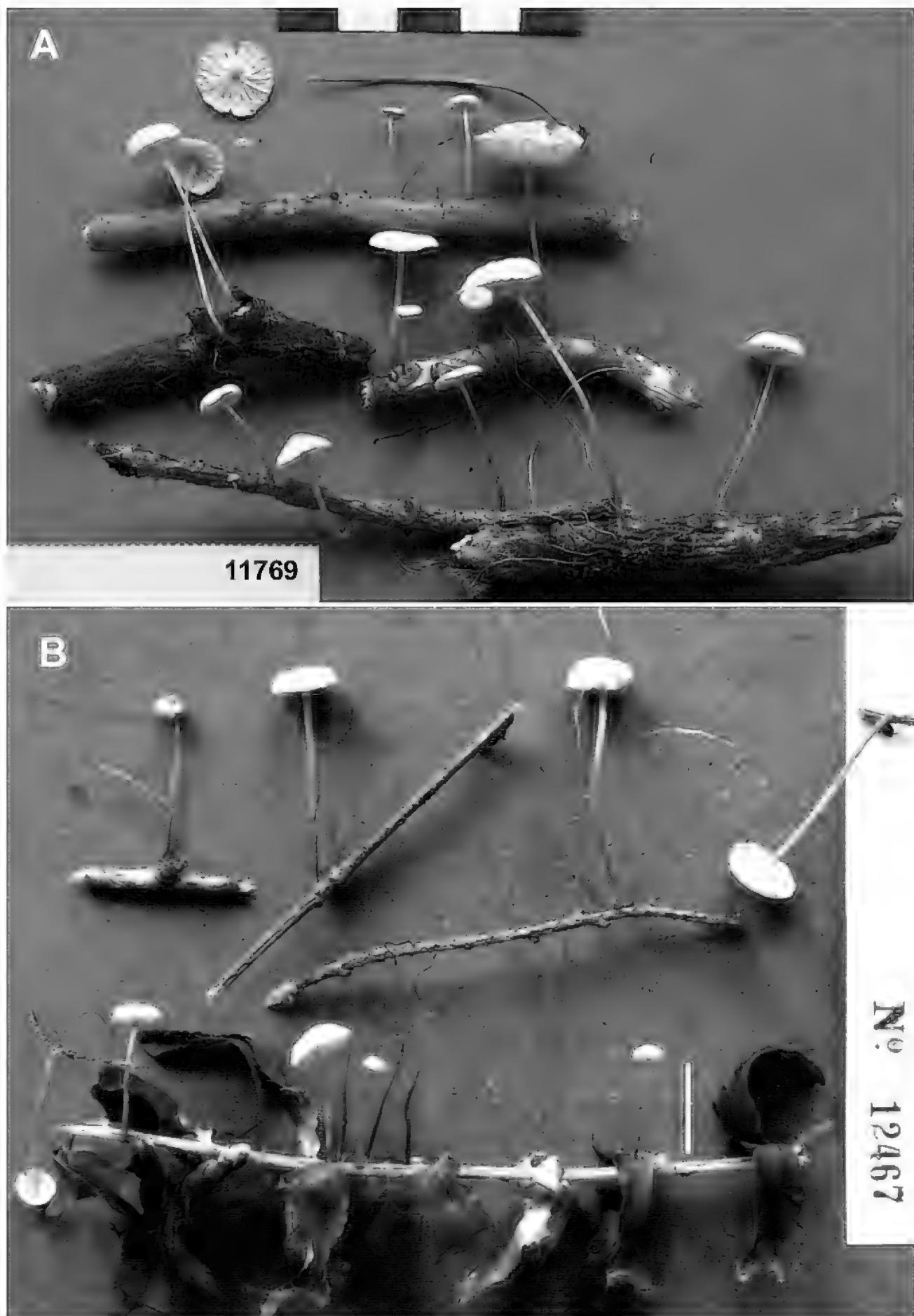
### **8. *Mycetinis opacus* (Berk. & M.A. Curtis.) A.W. Wilson & Desjardin., 2005. *Mycologia* 97: 677-678.**

**Basionym:** *Marasmius opacus* Berk. & M.A. Curtis 1849. Hooker's J. Bot. 1: 99.  
 ≡ *Marasmiellus opacus* (Berk. & M.A. Curtis) Singer "1949" (1951). Lliloa 22: 300.

**Holotype.** **United States**, South Carolina, Darlington Co., Society Hill, N34°30'47", W79°51'03", VI, Curtis 1241 (FH, K).

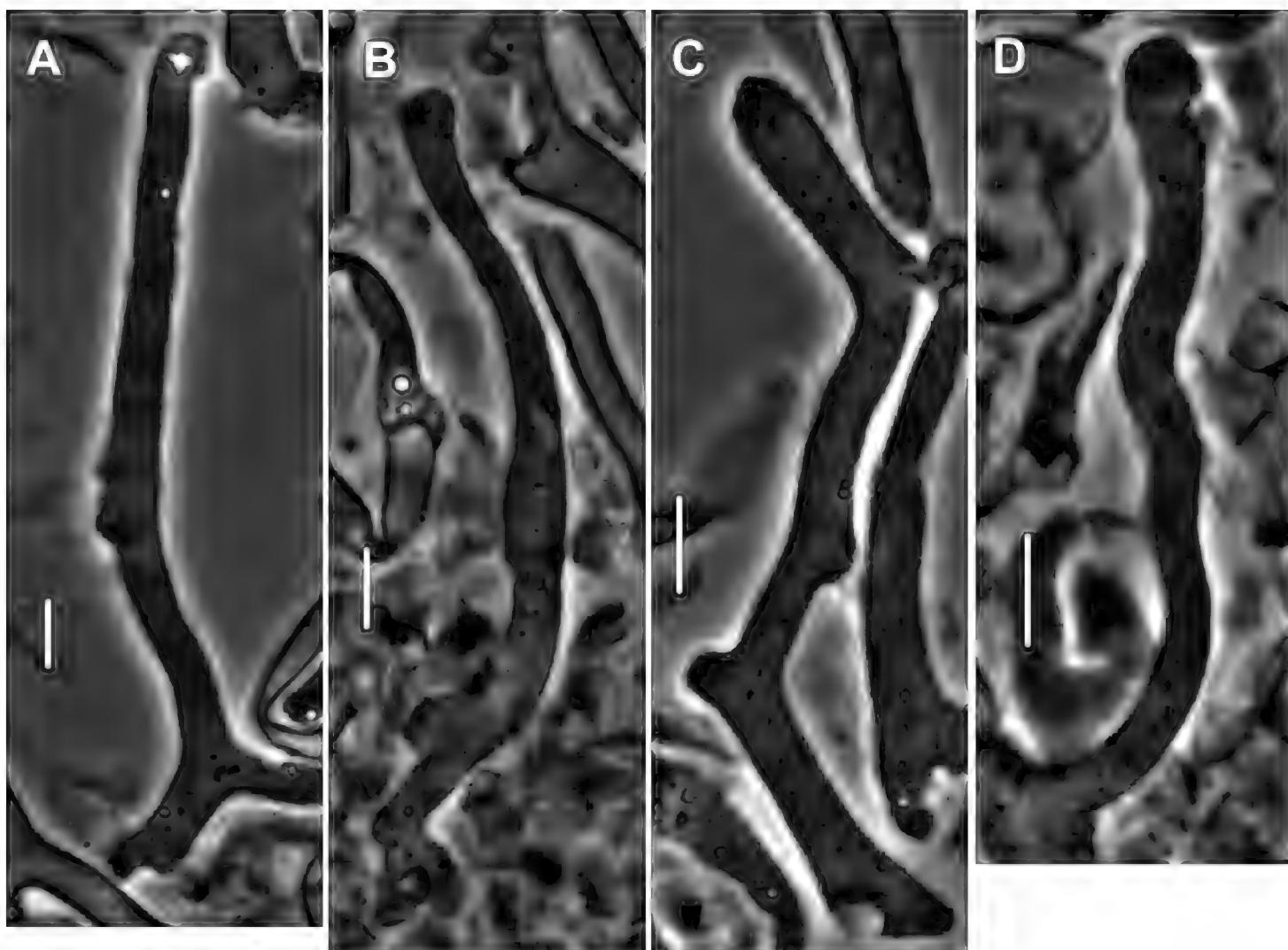
**Diagnosis.** 1) Basidiomata of moderate size, gracile (pileus 3–20 mm broad; stipe 10–45 × 1.5–2.5 mm); 2) rhizomorphs usually plentiful, slender, pallid, usually erect; 3) pleurocystidia fusiform, usually submammilate; 4) cheilocystidia arbuscular with coarse branches, not setulose; 5) pileipellis microstructures differing significantly from pileus margin to disc; 6) odor and taste negligible (not alliaceous); 7) distribution in eastern North America (with some extralimital reports); 8) fruiting chiefly on dead *Rhododendron* twigs and leaves.

**Description.** **Basidiomata** (Fig. 50) of moderate size, marcescent, reviving. **Pileus** 3–15(-20) mm diam, convex with decurved margin when young, expanding with age to plano-convex or sometimes plane with decurved or uplifted margin; disc rarely subumbonate, sometimes slightly depressed; margin entire when young, remaining so throughout maturation or becoming striate to rugulose-striate in age; surface smooth, sueded-like, dry, opaque, finely powdery or granulose overall when young, disc remaining so in age and margin sometimes becoming glabrous; when young, disc colored "pale vinaceous fawn" 6C2-3, "drab" 6D3, "hair brown" 6D-E3, near "Rood's brown" 7D5, "chestnut brown" 7D-E4-5, or "clove brown" 7F3-4, with a slightly paler margin, with maturation disc region retaining greyish brown tones or fading to "vinaceous



**Figure 50.** *Mycetinis opacus*. Basidiomata. **A** TFB 11769 (TENN-F-59880) **B** TFB 12467 (TENN-F-60541). Standard bars: **A** = ruler in millimeters. **B** = 20 mm.

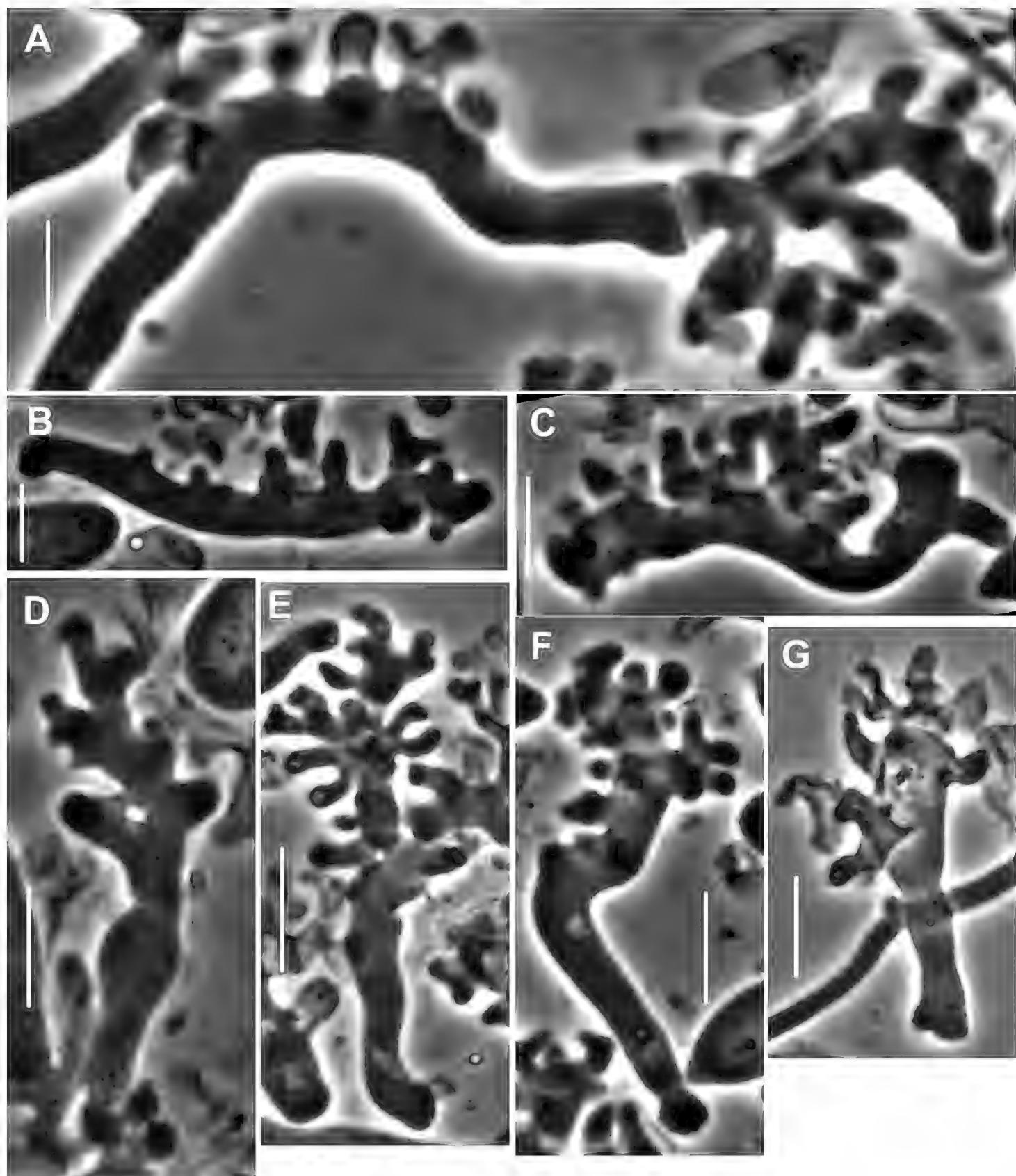
buff" 6C3-4, pale greyish yellow 5D3, pale brownish orange 5C3-4, "pale vinaceous fawn" 5-6B3, "pale cinnamon pink" 5A2, or "pale yellow-orange" 4A3, margin in age fading to "tilleul buff" 5-6B2, "pale pinkish cinnamon" 6A2, "pale cinnamon pink"



**Figure 51.** *Mycetinis opacus*. Pileal hairs. Standard bars = 10 µm. TFB 14629 (TENN-F-69344).

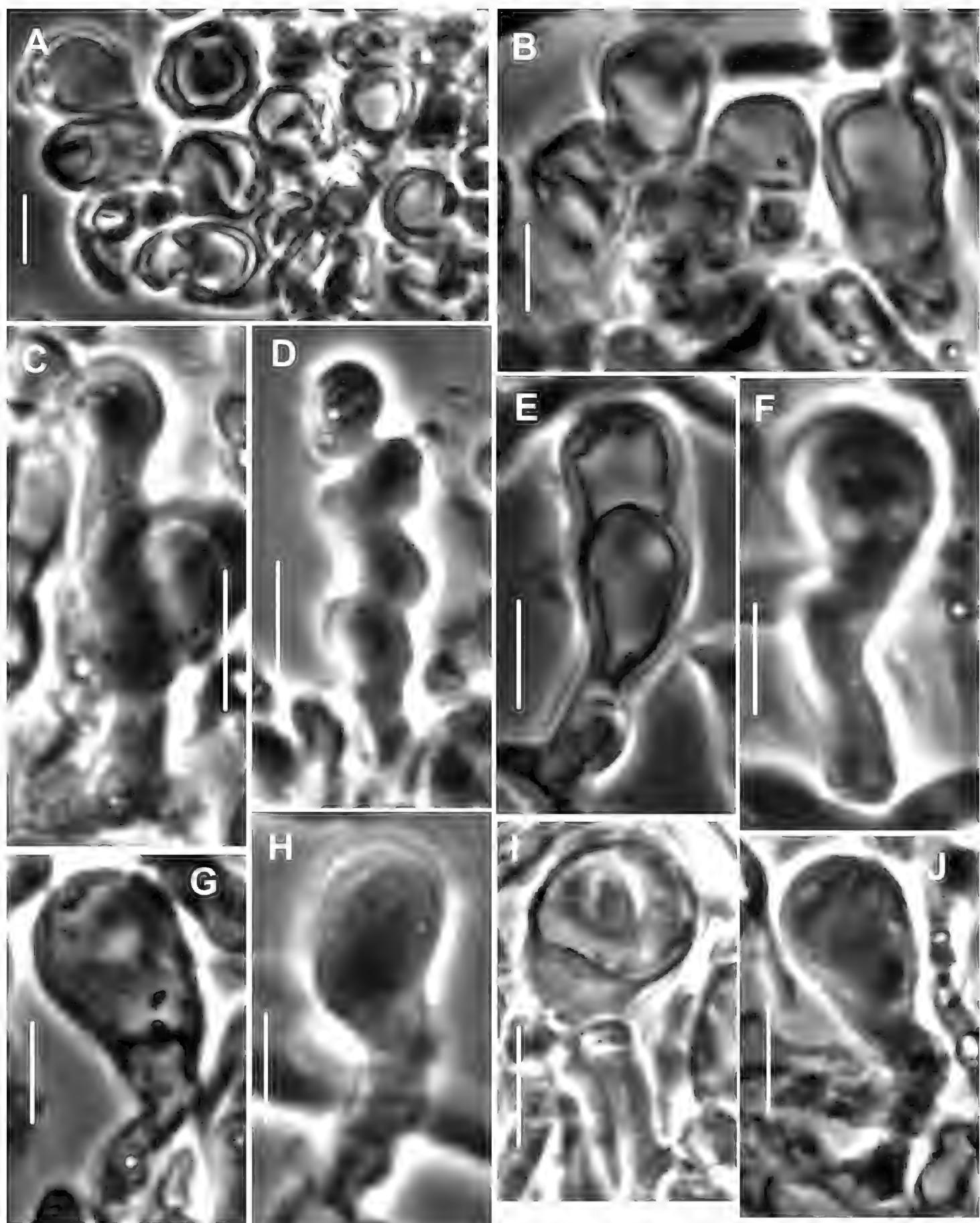
5A2, “pale yellow-orange” 4A3, pale greyish buff or white; in age pileus typically with a pale greyish brown disc region and white margin, in wet weather entire pileus sometimes becoming white. Context thin (<1 mm), buff. **Lamellae** adnate or shallowly adnexed, subdistant, total lamellae 12–18, non-intervenose to somewhat so, especially near pileus margin, seldom forked, sometimes wavy in outline, non-marginate, white, buff, “pale ochraceous buff” 4A2, not discoloring. **Stipe** 10–40 (-45) × 1.5–2.5 mm, central, terete or seldom compressed, equal, solid at first becoming hollow in age, pruinose to pubescent or fibrillose overall or with furfuraceous base, insititious, tough; apex buff, pinkish buff, “pale cinnamon pink” 5B2-3 or near “tawny olive” 5C4, base brownish grey 5C2-3, “drab” 6D3, “hair brown” 6-7D-E3, “buffy brown” 6-7D4-5 “fuscous” 6E4, “chestnut brown” 6-7E4. **Rhizomorphs** (Fig. 50) abundant, well-developed, cord-like, ranging from buff to orange white to pale brownish orange, greyish brown or light brown, often branched and forming tangled masses. **Odor** not distinct or faintly sweet; **taste** not distinctive.

**Habitat and phenology.** Scattered or gregarious on fallen twigs and leaves of *Rhododendron maximum* and *Tsuga canadensis*, rarely on debris of *Quercus* spp., *Pinus* spp or undetermined deciduous hardwoods; common in temperate eastern North America, rare in southwestern United States and Japan. Known U.S. distribution: Arizona, Connecticut, Georgia, Illinois, Missouri, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Tennessee, Texas, Virginia, West Virginia.



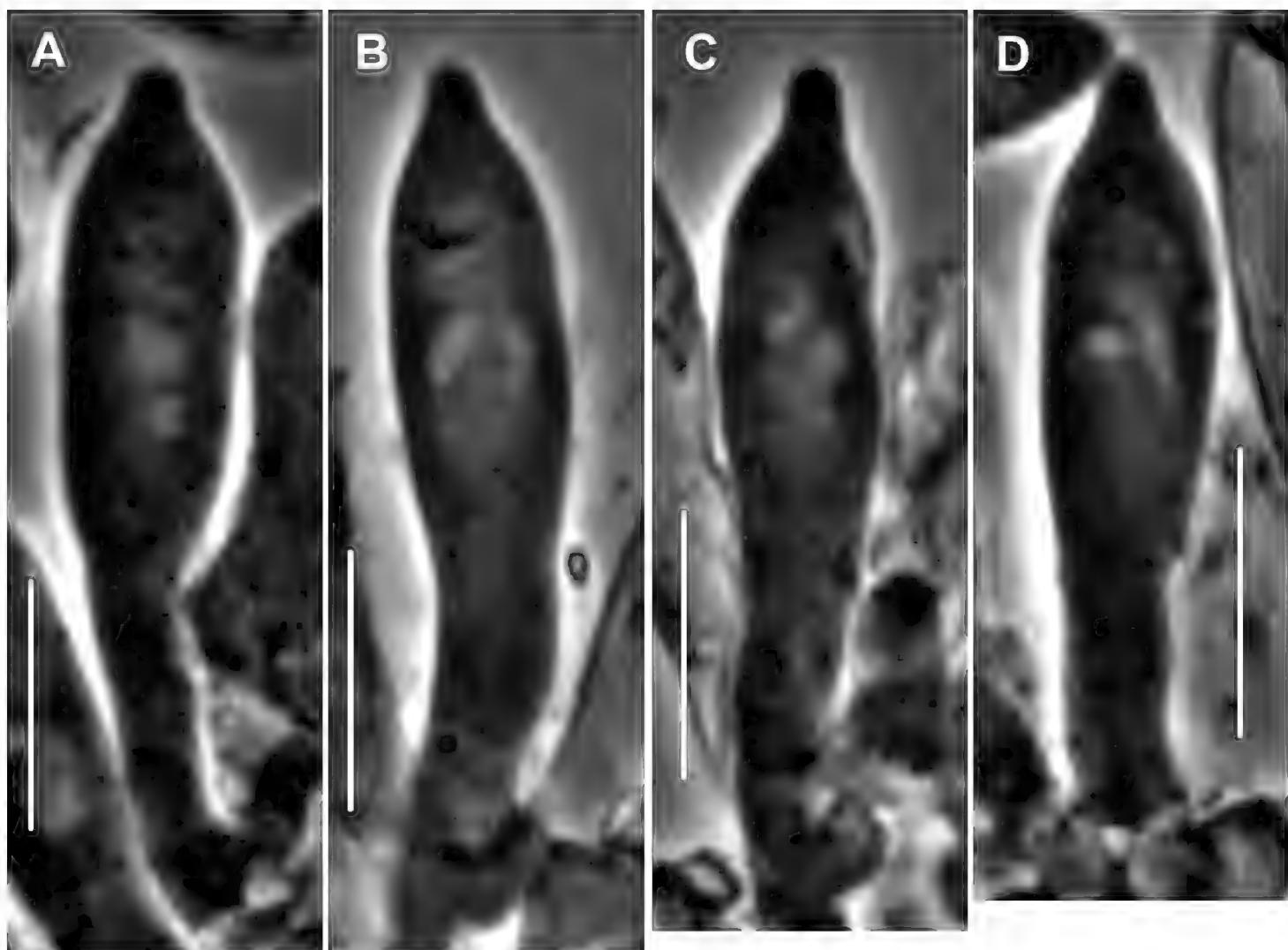
**Figure 52.** *Mycetinis opacus*. Pileipellis elements. **A–C** Diverticulate hyphae. **D–G** Broom cell-like pileocystidia. Standard bars = 10  $\mu\text{m}$ . TENN-F-69344.

**Pileus margin pileipellis** a modified *rameales*-structure, composed of two conspicuously clamped elements: 1) hyphae repent, diverticulate (Fig. 52A–C), 3–5.5  $\mu\text{m}$  diam, firm-walled, producing side branches; side branches 2–7  $\times$  3–4  $\mu\text{m}$  diam, broadly digitate or cylindrical, often dichotomous; and 2) broom cell-like pileocystidia (Fig. 52D–G) 31–42  $\times$  9–14  $\mu\text{m}$  overall, arbuscular, stalked (stalk 4–35  $\times$  3.5–5.5  $\mu\text{m}$ , firm-walled, clamped at base), unexpanded distally, producing apical branches irregularly in 360°(branches 2–7  $\times$  3–4.5  $\mu\text{m}$ , rounded at apex, rarely di-



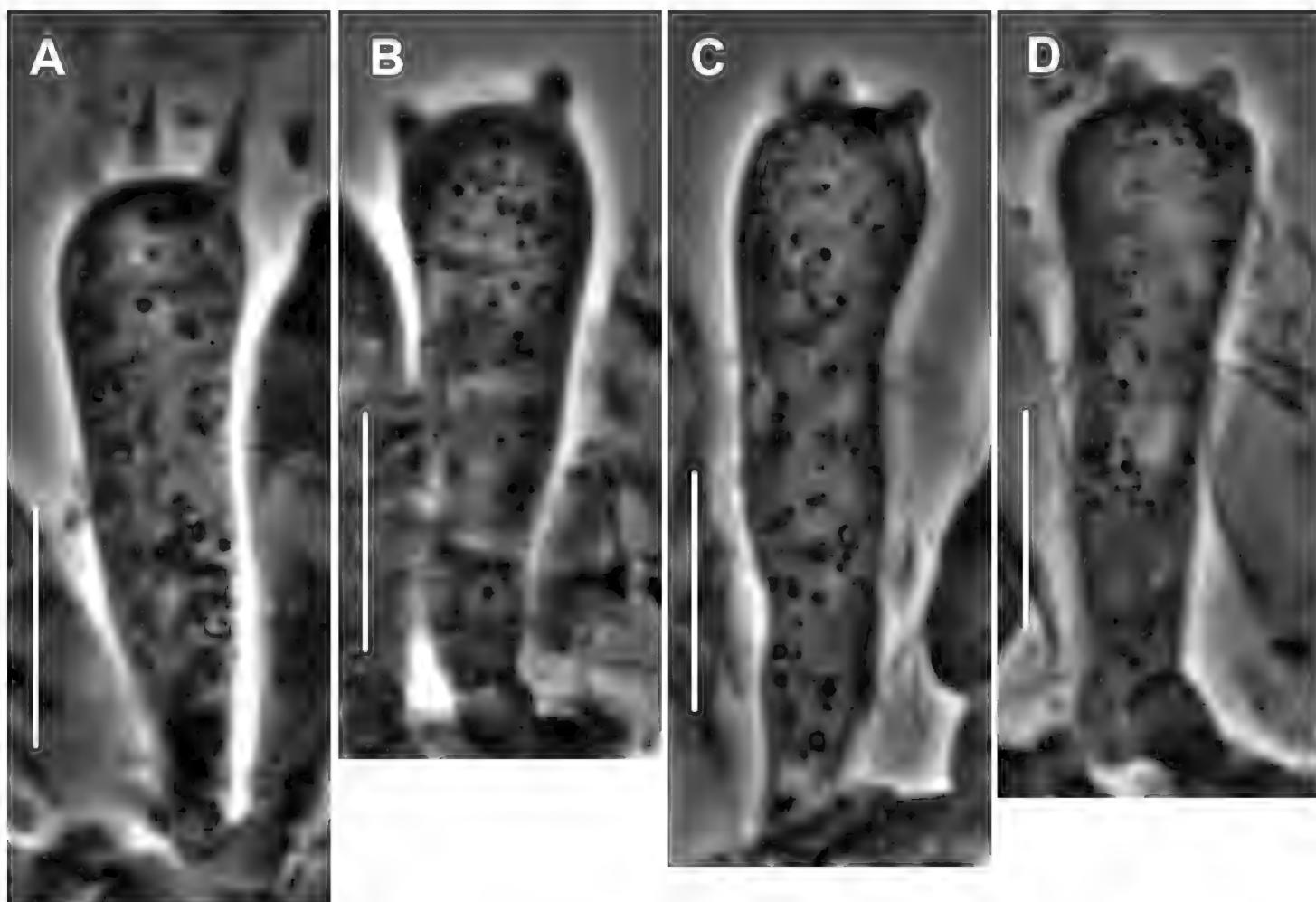
**Figure 53.** *Mycetinis opacus*. Pileipellis elements; thick-walled inflated hyphal termini. **A** Perpendicular view of hymeniform epicutis **B** Side view of a small cluster of inflated elements **C–J** Individual thick-walled, inflated hyphal termini. Standard bars = 10 µm. TFB 14629 (TENN-F-69344).

chotomous); branches resembling those of diverticulate hyphae, often evacuating but not collapsing (i.e. remaining as “exoskeletons” in pileipellis). **Pileus disc pileipellis** constructed of the following: 1) occasional pileal hairs (Fig. 51)  $10\text{--}80 \times 3.5\text{--}5.4$  µm, cylindrical, arising as side branches of repent hyphae, often minutely roughened,



**Figure 54.** *Mycetinis opacus*. Pleurocystidia. Note submammillate apices. Standard bars = 10  $\mu\text{m}$ . TFB 14629 (TENN-F-69344).

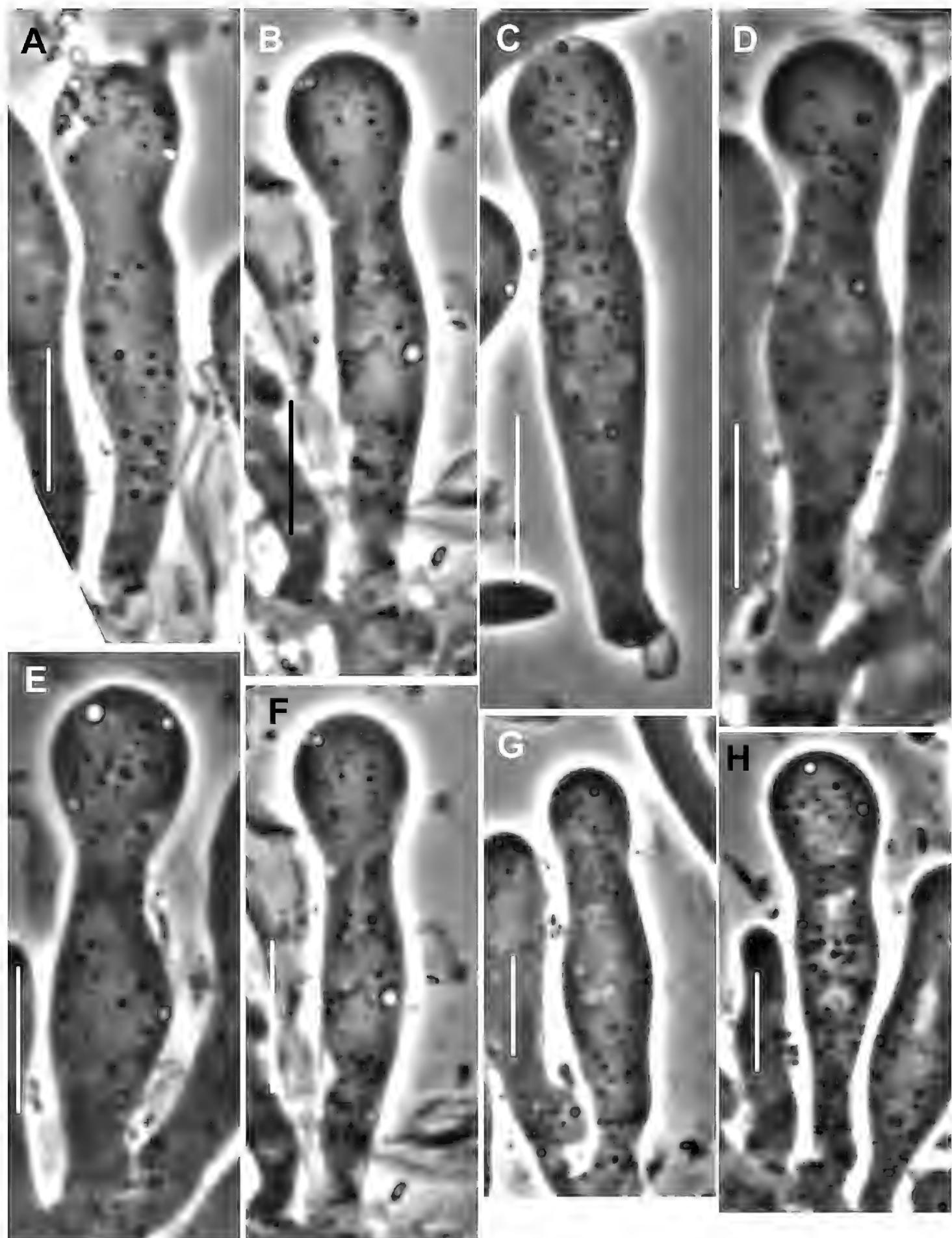
usually subcapitulate; 2) an irregularly hymeniform layer of inflated hyphal termini (Fig. 53) 14–34  $\times$  (6-)8–15  $\mu\text{m}$ , ranging from digitate, gnarled-digitate, ellipsoid to broadly clavate, almost always thick-walled over inflated portion [wall -1.5  $\mu\text{m}$  thick, refringent (PhC), sometimes vaguely pigmented yellowish], obscurely clamped, apparently immersed in a thin slime matrix; 3) widely scattered pileocystidia as in pileus margin, but generally crumpled and difficult to recognize; and 4) underlying a thicker tightly interwoven thatch of hyphae 3–7  $\mu\text{m}$  diam, smooth, thick-walled (wall -1  $\mu\text{m}$  thick, not gelatinized), conspicuously clamped. Pileus trama hyphae interwoven. Hymenophoral trama regular; hyphae 3.0–8.0  $\mu\text{m}$  diam, filamentous, smooth or encrusted nearest the pileipellis, non-gelatinous, hyaline or subhyaline, inamyloid, thin- to thick-walled (up to 1.5  $\mu\text{m}$  thick). **Pleurocystidia** (Fig. 54) common, 22–28  $\times$  6–7  $\mu\text{m}$ , fusiform to narrowly fusiform, usually submammillate, conspicuously clamped; contents homogeneous with 1–2 vaguely vacuolated areas in mid-section. Basidioles clavate to ampulliform; **basidia** (Fig. 55) (16-)25–31 X (5-)8–10  $\mu\text{m}$ , clavate, often subcapitulate, 4-sterigmate, clamped; contents multi granular to multiguttulate. **Basidiospores** (Fig. 58B) (6.5-)7.5–10(-11)  $\times$  (2.8-)3.5–4.5(-5)  $\mu\text{m}$  ( $Q = 1.50–2.43$ ;  $Q^m = 1.98$ ;  $L^m = 8.23 \mu\text{m}$ ), ellipsoid to subamygdaliform, flattened somewhat adaxially, collybioid (hardly tapered proximally), thin-walled, inamyloid; contents often multigranular. **Cheilocystidia** (Fig. 57) 17–36  $\times$  4.0–8.5  $\mu\text{m}$ , resem-



**Figure 55.** *Mycetinis opacus*. Basidia. Note multigranular contents. Standard bars = 10  $\mu\text{m}$ . TFB 14629 (TENN-F-69344).

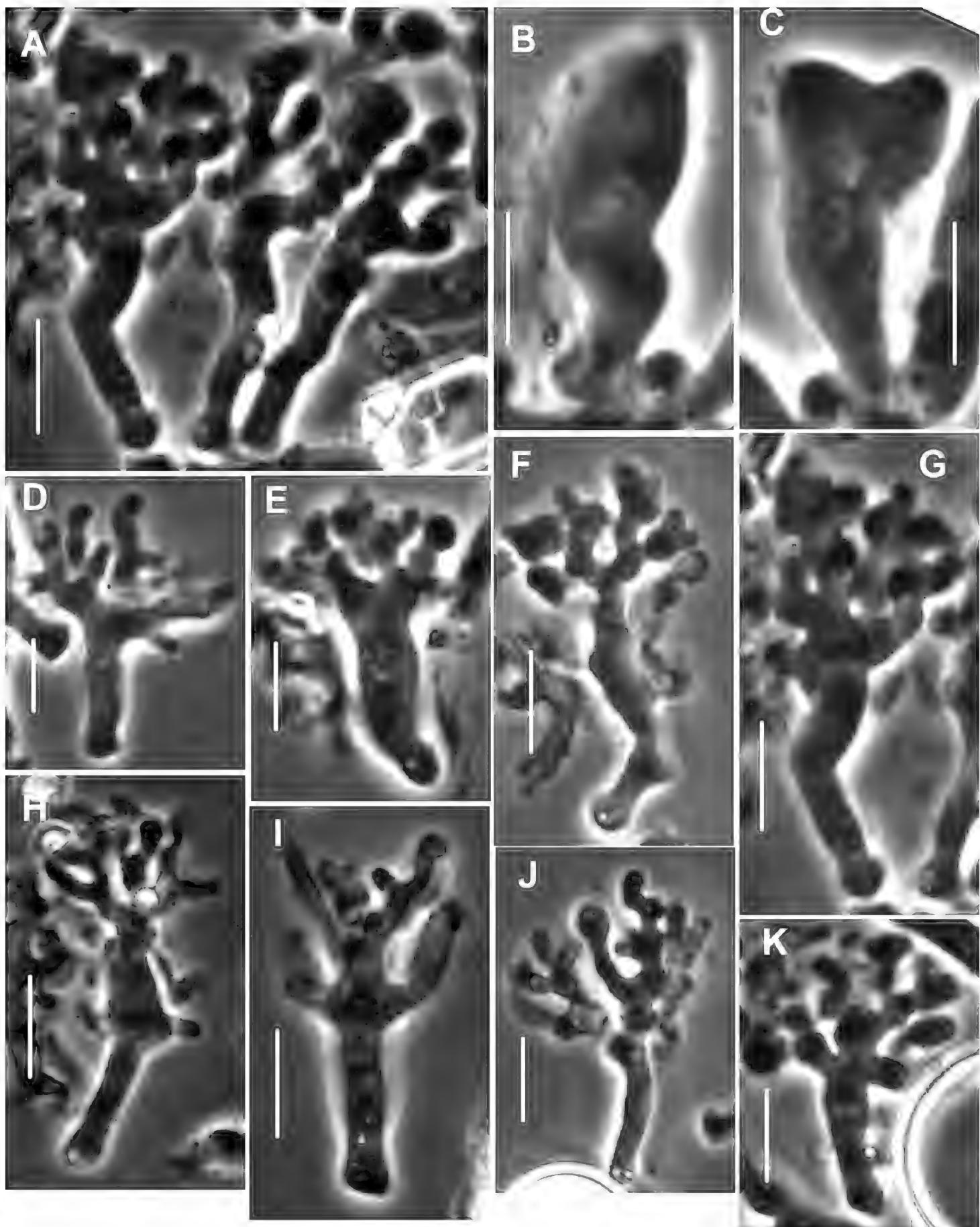
bling broom cell-like pileocystidia, sporadic (often absent, apparently produced on selected basidiomata), very variable, ranging from (occasionally) irregularly fusiform to bifurcate to (usually) stalked (stalk 7–17  $\times$  3–5.5  $\mu\text{m}$ , obscurely clamped, firm-walled), not expanded distally, producing a cluster of gnarled-digitate diverticula; diverticula 2–8  $\times$  2–2.5(-3)  $\mu\text{m}$ , rounded at apex, occasionally inflated somewhat and occasionally dichotomous. **Stipe medullary hyphae** monomitic, 2.0–4.5(-6.0)  $\mu\text{m}$  diam, strictly parallel, free (not involved in slime matrix or adherent in sheets), firm-to thick-walled (wall ~1.5  $\mu\text{m}$  thick, hyaline), conspicuously clamped. Stipe **cortical hyphae** cylindric, ranging from hyaline (stipe apex) to pale yellow (stipe base), non-encrusted, inamyloid, thick-walled (wall ~1.5  $\mu\text{m}$  thick). **Stipe vesture** a poorly developed *Rameales*-structure with numerous, erect caulocystidia; **caulocystidia** (Fig. 58A) digitate to vermiciform, often cudgel-shaped, similar to pileus hairs, mostly hyaline and thin-walled on stipe apex, pale yellowish brown to brownish orange and thick-walled (wall ~1.5  $\mu\text{m}$  thick) near stipe base. **Rhizomorph tissue** similar to that of stipe; rhizomorph medullary and cortical hyphae undifferentiated, parallel or subparallel, firm- or thick-walled. Rhizomorph vesture absent, in some areas composed of a thin layer of loosely interwoven, irregular-shaped hyphae with scattered, short and broad diverticula.

**Commentary.** Three characters are inconspicuous but diagnostic: 1) pleurocystidia are usually submammilate, unlike the acute forms found in sect. *Androsacei* and



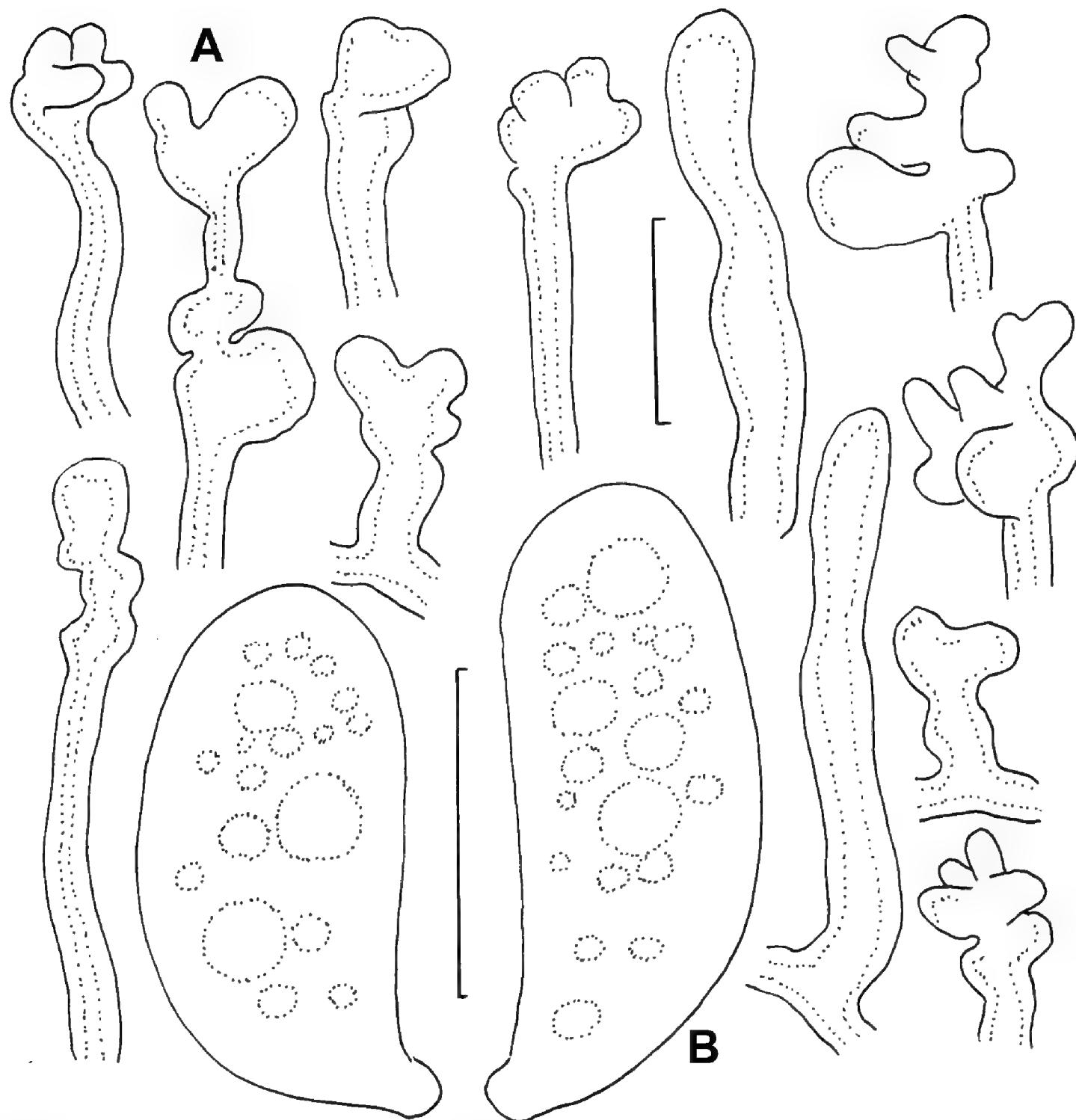
**Figure 56.** *Mycetinis opacus*. Ampulliform hymenium structures. **A** Basidium with ampulliform shape **B–H** Sterile ampulliform structures. Standard bars = 10  $\mu\text{m}$ . TFRB 14629 (TENN-F-69344).

sect. *Perforantia*; 2) cheilocystidia are generally of the *siccus*-type, but branches are coarse and not setulose; and 3) pileipellis microstructures differ significantly from pileus margin to disc.



**Figure 57.** *Mycetinis opacus*. Cheilocystidia. **A** Cluster of three cheilocystidia **B, C** Simple cheilocystidia **D–K** Arbuscular broom cell-like individuals. Standard bars = 10 µm. TFB 14629 (TENN-F-69344).

Basidiomata are usually accompanied by numerous rhizomorphs, often as tall as stipes (or taller), unlike other members of the clade in which rhizomorphs, if present, are short and extremely thin (but pallid, unlike the black or dark brown of the rhizomorphs of sects. *Androsacei* and *Perforantia*).



**Figure 58.** *Mycetinis opacus*. **A** Caulocystidia **B** Basidiospores. Standard bar: **A** = 20  $\mu\text{m}$ ; **B** = 5  $\mu\text{m}$ . TFB 14629 (TENN-F-69344).

Although the term used to describe pileipellis elements is the same as that used in *Marasmiellus* sect. *Rameales* ("ramealis-structure"), the two structures are significantly different. In its original use, the term represents a structure in which setulae are usually  $2\text{--}5(-8) \times 0.7\text{--}1.2 \mu\text{m}$  (i.e. *Marasmiellus appalachianensis* TFB 14610, MS; *Ma. ramealis* TFB 4727 Sweden), while the side branches and arbuscular apical branches in *Mycetinis* are appreciably coarser,  $2\text{--}10 \times 2\text{--}3 \mu\text{m}$ . In fact, Desjardin (1997: figs 6–11) included *Ma. appalachianus* Desjardin together with *Ma. opacus* (see Desjardin et al. 1993: figs 10–16) in subsect. *Opacini*, although pileipellis structures are quite different.

In the most detailed discussion of *Ma. opacus* thus far (Desjardin et al. 1993) the following was reported: " Features diagnostic for *M. opacus* include: (a) convex,

rugulose-striate pileus colored pale greyish brown on the disc and white on the margin; (b) subdistant, narrow, white to buff-coloured lamellae; (c) pubescent, insititious stipe with pallid apex and brownish grey base; (d) buff or pale greyish brown rhizomorphs; (e) basidiospore mean of  $8.3 \times 3.7 \mu\text{m}$ ; (f) diverticulate cheilocystidia; (g) pileus disc with clavate to sphaeropedunculate, often thick-walled terminal cells, and pileus margin a *Rameales*-structure; (h) caulocystidia similar to pileipellis elements; (i) clamped, inamyloid hyphae; and (j) fructification on leaves and wood of *Rhododendron*, *Quercus* and *Tsuga*." This diagnosis, however, was compiled to distinguish *Ma. opacus* from other *Marasmiellus* taxa, but not from other taxa of *Mycetinis*, which, after all, was not recognized as a discrete generic unit at that time.

Desjardin et al. (1993) included discussion of cultural and sexual compatibility studies and cited numerous examined specimens. Little need be added. Later, Desjardin (1997) summarized *Marasmiellus* taxa from the southern Appalachian Mountains, placing *Ma. opacus* in section *Rameales* subsection *Opacini* Singer.

Presumably, Singer's "1949" (1951) placement of *Marasmiellus opacus* in *Marasmiellus* sect. *Rameales* presumed its conformity to the description of the section, which was attributed to Lange (1921) as "sect. *Ramealis* gen. *Marasmii*", the type species of which was *Marasmiellus ramealis* (Bull. ex Fr.) Singer [ $\equiv$  *Agaricus ramealis* Bull.: Fr] a combination transferred concurrently. Singer (1973) proposed *Marasmiellus* sect. *Rameales* subsect. *Opacini* to accommodate several neotropical taxa but a description of *M. opacus* was furnished as extra-limital. Singer (1973) summarized *Marasmiellus* in neotropical regions and included section *Rameales* Singer, which he had proposed in 1951 (Lilloa 22: 299. "1949"). Within sect. *Rameales*, he (Singer 1973: 102) proposed subsection *Opacini*, typified by *Marasmius opacus* Berk. & M.A. Curtis, even though he did not explain his choice of type, nor did he take up the species. Singer's (1973) later description of *Marasmiellus opacus* supplied needed taxonomic information, and among the specimens he examined were some from the southeastern United States (but with no illustrations). From all this, there is no evidence that he intimately knew *M. opacus*, only that he did not consider its presence in the neotropics. At the same time, subsection *Opacini* included eight species, so subsect. *Opacini* was not monotypic.

**Specimens examined.** **Japan**, Tottori Pref., N $35^{\circ}30'35''$ , E $134^{\circ}14'09''$ , Kokufu Town, 4.X.1989, coll. RHP (annot. DE Desjardin), TFB 2400 (TENN-F-48740). **United States**, Georgia, Rabun Co., vic. Clayton, Warwoman Dell Picnic Area, N $34^{\circ}54'52.62''$ , W $83^{\circ}21'14.21''$ , 18.VII.1989, coll. S.A. Gordon, TFB 2788 (TENN-F- 48710); Mississippi, Harrison Co., vic. Saucier, Tuxachanie Hiking Trailhead, N $30^{\circ}39'43.61''$ , W $89^{\circ}08'14.70''$ , 10.VII.2014, coll. RHP, TFB 14490 (TENN-F-69190); North Carolina, Buncombe Co., Asheville, Blue Ridge Parkway, N $35^{\circ}34'$ , W $82^{\circ}29'$ , milepost 363, 4.VIII.1959, Coll. L.R. Hesler, TENN-F-23348); Macon Co., vic. Highlands, road to Cliffside Lake, end of road, N $35^{\circ}04'50.01''$ , W $83^{\circ}14'03.07''$ , 8.VII.2016, coll AS Methven, TFB 14629 (TENN69344); Highlands Biological Station, N $35^{\circ}04'43.99''$ , W $83^{\circ}14'12.69''$ , 19.VI.1963, coll. L.R. Hesler (TENN-F-25556); Tennessee, Blount Co., GSMNP, Cades Cove, N $35^{\circ}33'46''$ , W $83^{\circ}50'50$ , 22.V.2005, coll. J.L. Mata, JLM 1601 (TENN-F-61960); vic. Townsend,

GSMNP, Turkey Pen Trailhead, N35°36'41.84", W83°44'48.29", coll. RHP, TFB 13650 (TENN-F-63084); Sevier Co., GSMNP, Indian Gap, N35°36'36.09", W83°26'19.24", 2.VIII.1936, coll. L.R. Hesler (TENN-F-10199).

### **9. *Mycetinis prasiosmus* (Fr.: Fr.) R.H. Petersen, comb. nov.**

Index Fungorum no. 553205

**Basionym:** *Agaricus prasiosmus* Fr.: Fr. (1821). *Systema Mycol.* 1: 148.

[≡ *Agaricus prasiosmus* Fr. 1818. *Observationes Mycologicae* 2: 153.]

≡ *Marasmius prasiosmus* Fr.: Fr. 1838. *Epicrisis* p. 378.

**Type specimen** (Neotype, hic design.). Sweden, Västergötland, Mölndal Parish [N57°30'00", E12°01'00"], Gummebo, 5.X.1940, coll. T. Nathorst-Windahl (no. 2313), *Fungi Exsiccati Suecici* no. 1155 (S, BPI and presumed other distributions).

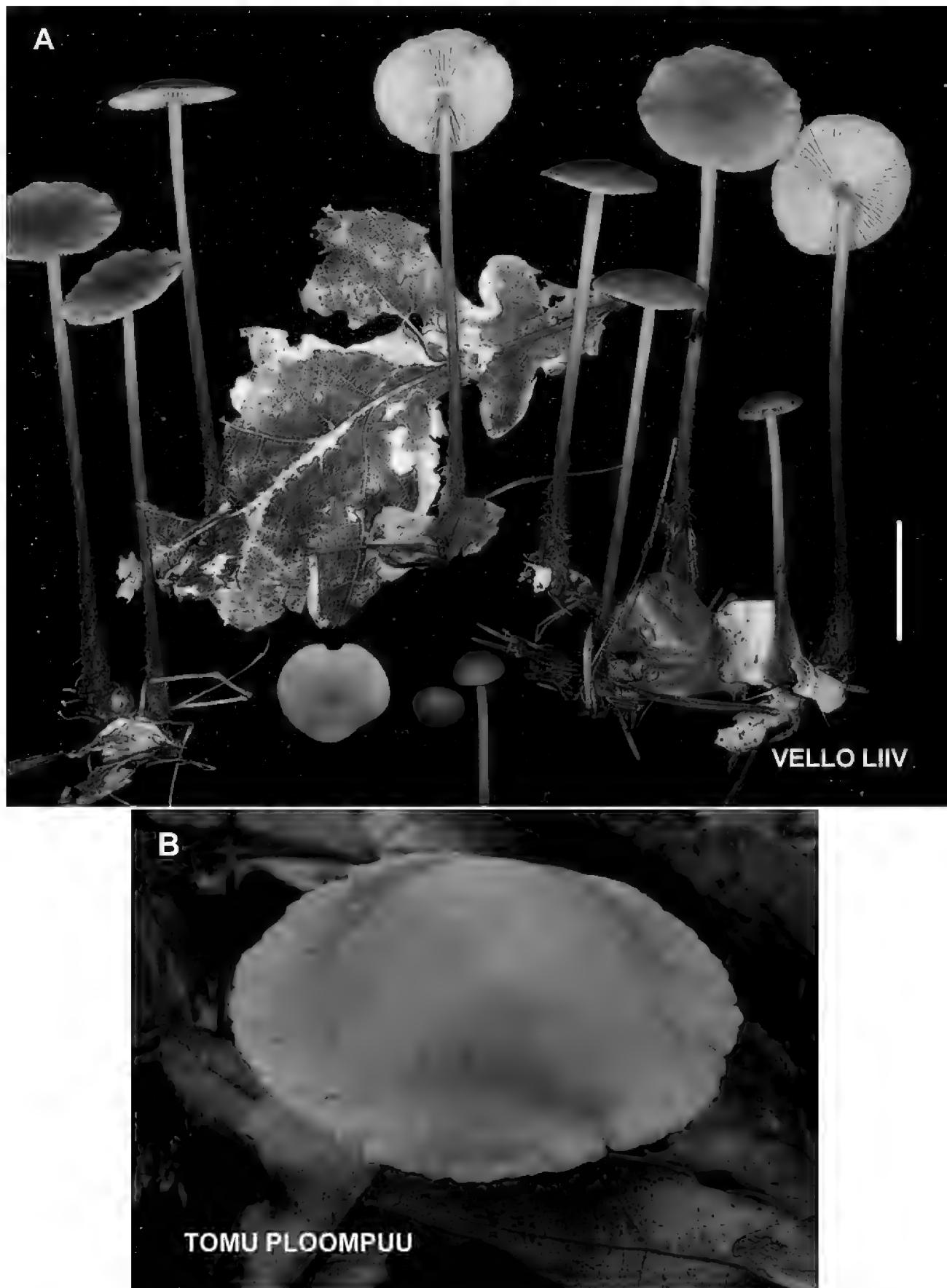
**Diagnosis.** 1) Basidiomata of moderate size, gracile (pileus 15–28 mm broad; stipe 60–100 × 1.5–4 mm); 2) lamellae close to crowded; 3) stipe vested over all; 4) pileipellis a hymeniform layer of inflated, ventricose-rostrate cells; 5) cheilocystidia not differentiated; 6) long, individual caulocystidia arising from a turf of cespitose, shorter individuals; 7) fruiting on rotting deciduous leaves; 8) distribution from Scandinavia to Italy.

See Appendix 2 for rationale of inclusion.

**Description. Basidiomata** (Fig. 59) of moderate size, gracile. **Pileus** (5-)15-28(-40) mm broad, convex, then applanate, with slightly involute then straight margin, hygrophanous, pale brown to reddish brown, drying to near "chamois" 4B4, smooth to suede-like, or sometimes slightly rugulose or grooved at margin when old; margin translucently striate 1–2 mm, when moist. Context relatively thin, white or brown.

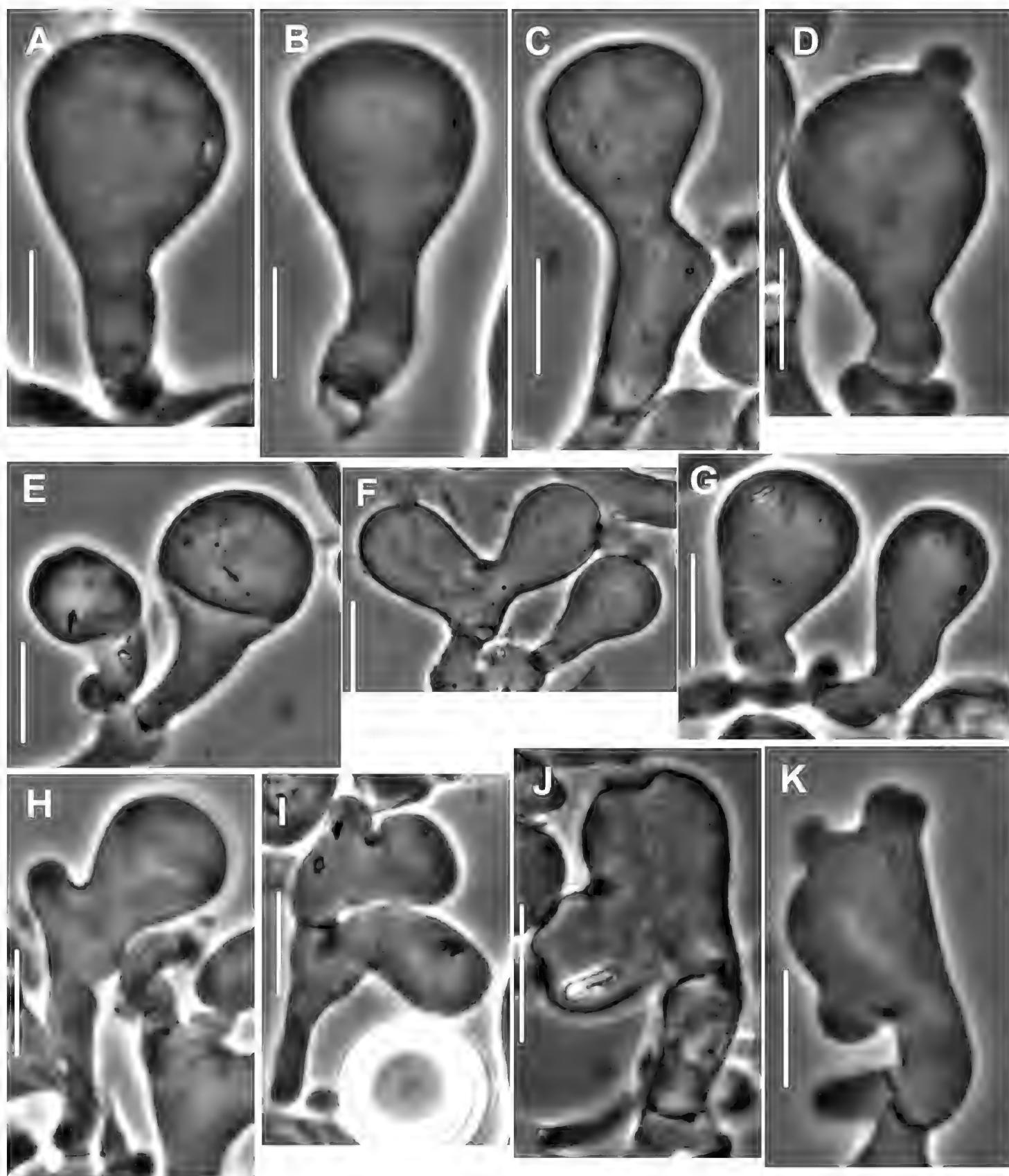
**Lamellae** adnate, slightly anastomosing when old, thin, ventricose, -2.5 mm broad, characteristically crisped when dried, seceding on drying and then appearing weakly pseudocollariate, now taffy colored with somewhat paler edge, total lamellae 70–80, through lamellae 18–28; lamellulae usually in one rank (rarely two). **Stipe** (20-)60–100 × 1.5–4 mm, terete to compressed, gradually tapering upward, slightly broadened above, straight or often curved at base, fistulose to lightly stuffed, upward avellaneoustan to brown, downward becoming duller brown, paler at apex, darker at base, entirely white pruinose to pubescent, sublannose villosity ranging from overall to sparse upward, extirpated by handling in midsection and resuming downward with dirty white to brown basal mycelium; stipe apex revealed by seceding lamellae white (not dark brown as in typical *Marasmius*); stipe base strigose, non-insititious, disappearing into surface of substrate. **Rhizomorphs** (see Antonin and Noordeloos 2010, fig. 119) rarely reported, apparently very slender, pallid, curly, probably not branched. **Odor** strong, of garlic; **taste** with distinct garlic component.

**Habitat and phenology.** Fruiting chiefly on decaying *Quercus* leaves but occasionally on other deciduous leaves(i.e. *Fagus*, *Betula*, *Carpinus*, etc.); widely distributed through Scandinavia and continental Europe; Autumn to late Autumn.



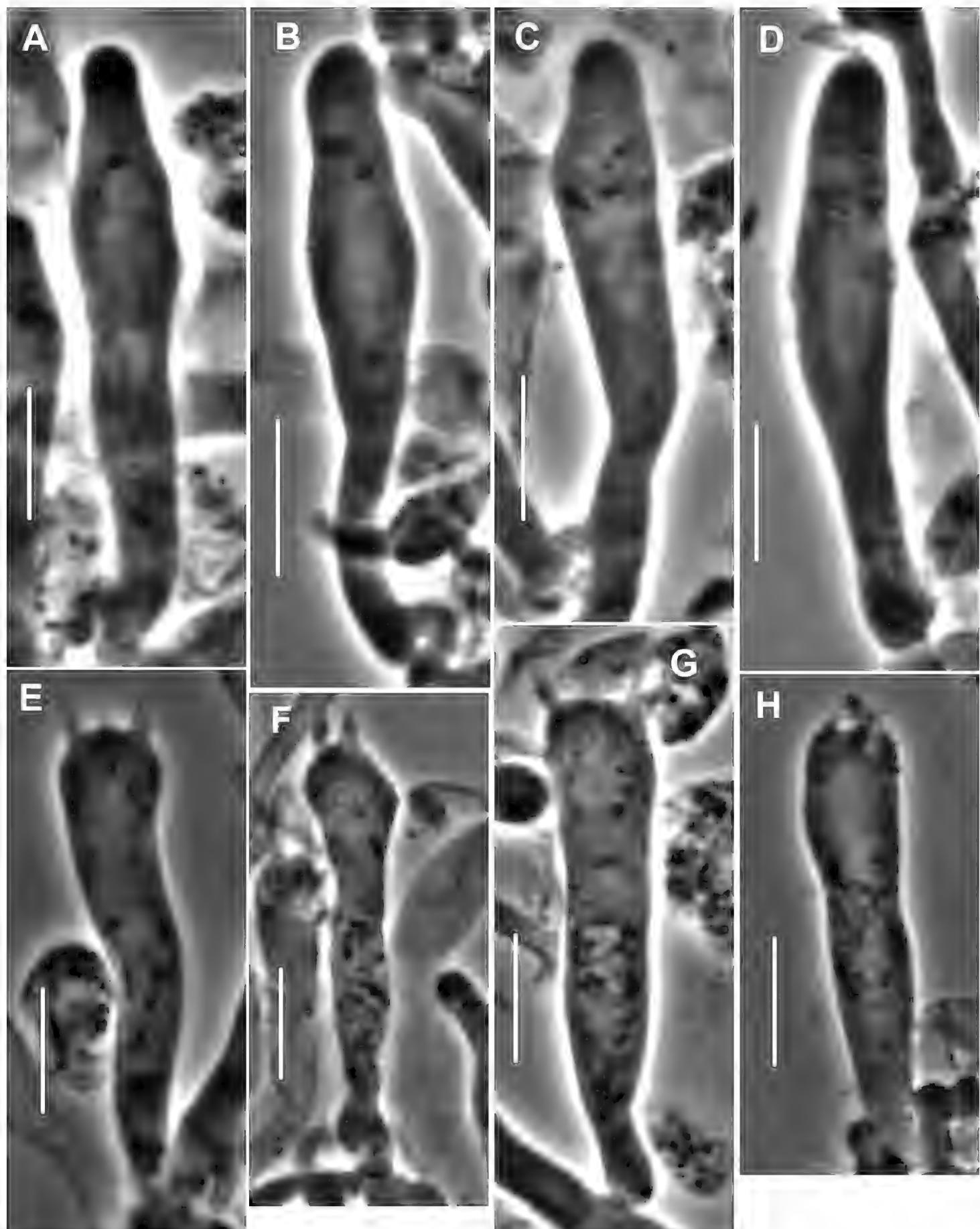
**Figure 59.** *Mycetinis prasiosmus*. Basidiomata. **A** TU 118971 **B** TU 101659. Standard bars: **A** = 20 µm; **B** not to scale. Photos courtesy Urmas Kohlalg.

**Pileipellis** (Fig. 60) including pileus margin a more or less hymeniform layer of inflated hyphal termini; inflated elements (14-)20–40 × (7-)10–22 µm, staked (stalk 6–16 × 5–8 µm), ranging from obpyriform, vesciculose, ventricose-rostrate to broadly clavate, mitten-shaped or lobate, conspicuously clamped, firm walled, hyaline or occasionally weakly pigmented. **Pleurocystidia** (Fig. 61A–D) 32–46 × 4–7 µm (at widest point),



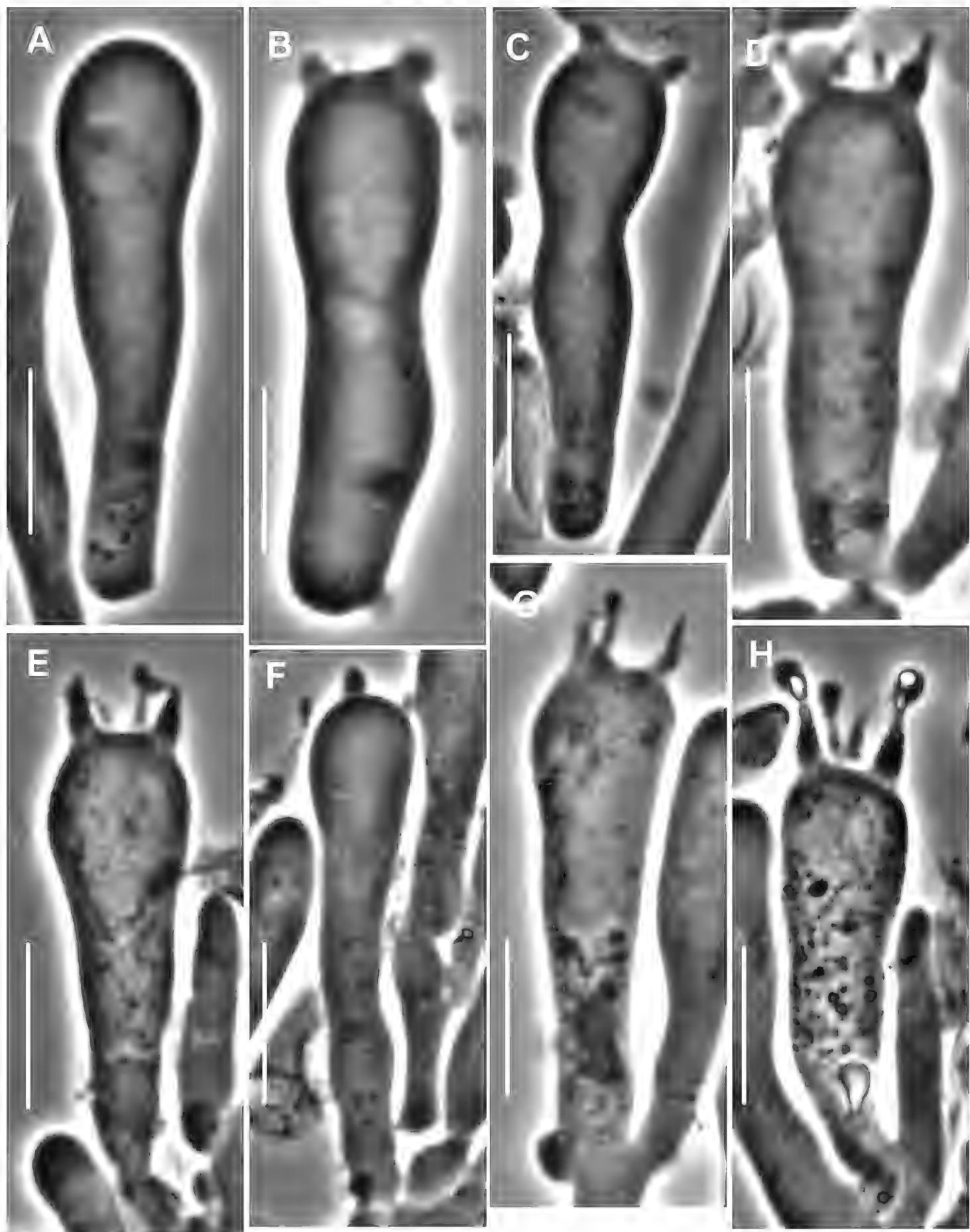
**Figure 60.** *Mycetinis prasiosmus*. Pileipellis structures. Standard bars = 10  $\mu\text{m}$ . UPS-F-740438.

narrowly to broadly fusiform, stalked, conspicuously clamped. Subhymenial hyphae branched, thin-walled, 2.5–4.0  $\mu\text{m}$  diam. Pileus and hymenophoral trama subregular to irregular; hyphae cylindrical or slightly inflated, hyaline, thin-walled, 2.0–14(20)  $\mu\text{m}$  diam. Basidioles 19–38  $\times$  (3.0)4.5–10  $\mu\text{m}$ , cylindrical to subampulliform; **basidia** (Figs 61E–H, 62) (26-)30–38  $\times$  (5.0-)6.0–10  $\mu\text{m}$ , cylindrical or clavate, hardly subcapitulate, (2-)4-sterigmate, conspicuously clamped; contents heterogeneous, appearing oily. **Basidiospores** (Fig. 63B) (7-)9–10.5(-12.5)  $\times$  (3.5-)4–5.5(-6)  $\mu\text{m}$  ( $Q = 1.63–2.25$ ;  $Q^m = 1.97$ ;  $L^m = 9.2 \mu\text{m}$ ), ellipsoid to elongate pip-shaped, tapered slightly proximal-



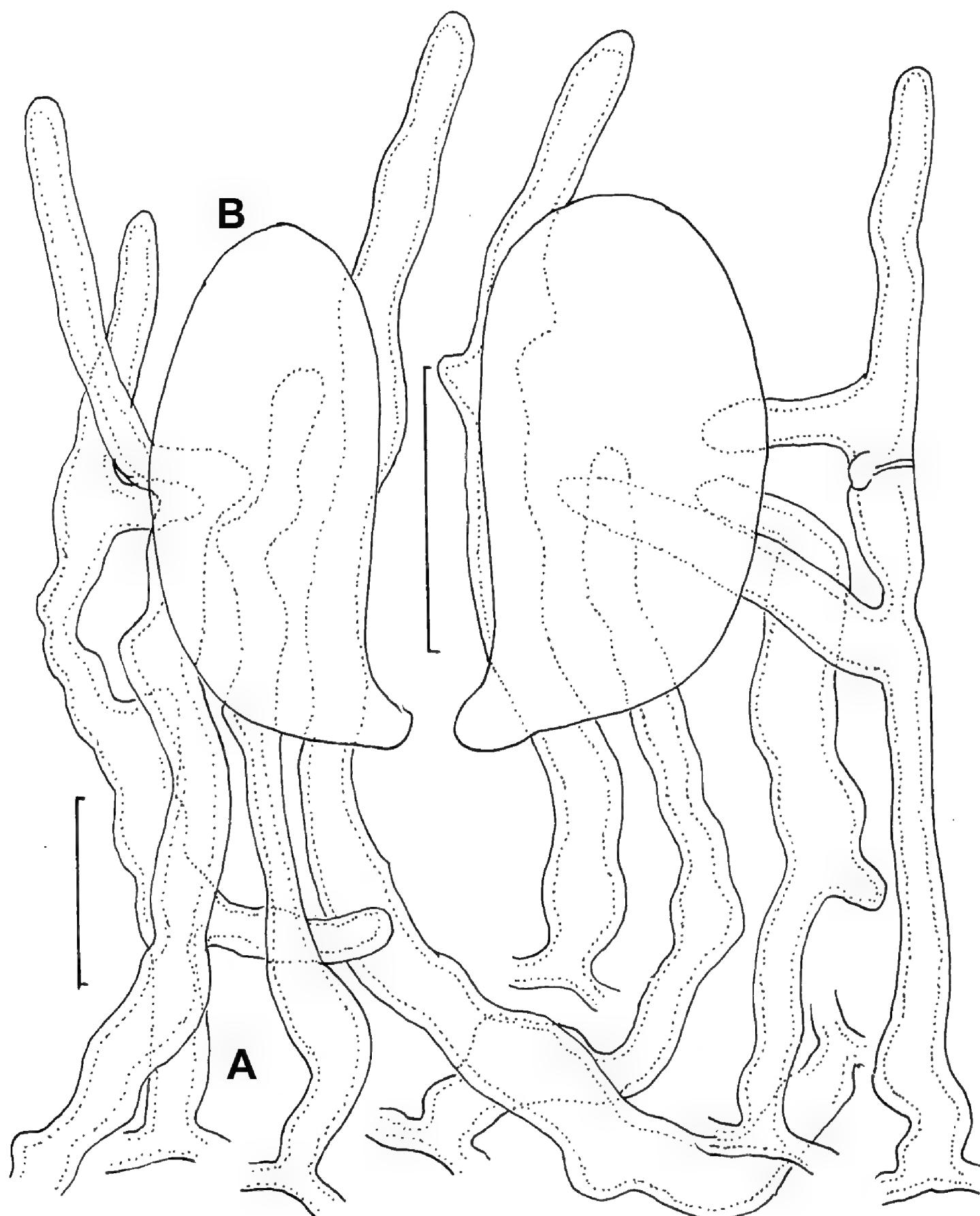
**Figure 61.** *Mycetinis prasiosmus*. Hymenial structures. **A–D** Pleurocystidia **E–H** Basidia. Standard bars = 10 µm. FES 1155 (S).

ly, thin-walled, inamyloid; contents more or less homogeneous. Lamellar edge fertile; **cheilocystidia** undifferentiated, but clavate to subampulliform structures present. **Stipe medullary hyphae** strictly parallel, free (not involved in slime matrix), of two types: 1) 6–15 µm diam, firm- to thick-walled (wall ~2 µm thick, hyaline), obscurely clamped;



**Figure 62.** *Mycetinis prasiosmus*. Hymenial structures. **A** Basidiole **B** Immature basidium **C** Two-sterigmate basidium **D–H** Mature 4-sterigmate basidia. NOTE: Clam connection on G. Standard bars = 10  $\mu\text{m}$ . UPS-F-740438.

and 2) 2–4  $\mu\text{m}$  diam, thick-walled (wall -1  $\mu\text{m}$  thick, weakly pigmented), seldom but conspicuously clamped. **Stipe cortical hyphae** 3–5  $\mu\text{m}$  diam, thick-walled (wall -1.5  $\mu\text{m}$  thick, weakly pigmented), seldom and obscurely clamped, producing caulocystidia as



**Figure 63.** *Mycetinis prasiosmus*. **A** Caulocystidia **B** Basidiospores. Standard bars: **A** = 10 µm; **B** = 5 µm. FES 1155 (S).

side branches. **Caulocystidia** (Fig. 63A) of two types: 1) 20–45 × 7–9.5 µm, gnarled, thick-walled (wall ~1.0 µm thick, hyaline), occasionally branched, in a turf; and 2) 49–120 × 7–10 µm, sinuous, occasionally branched, rarely internally clamped, thick-walled (wall ~1.0 µm thick, hyaline to weakly pigmented); caulocystidia on lower stipe retaining the basic turf but with densely gregarious (not synemmatoid-like) longer caulocystidia.

**Commentary.** This treatment includes *Mycetinis querceus* ss Antonín and Noordeloos (2010). The case for typification and acceptance of *Mycetinis prasiosmus* is included as Supplementary Data 1.

It might be expected that Noordeloos (2012) followed the nomenclature set out by Antonín and Noordeloos (2010), including *Mycetinis querceus* as part of the Scandinavia mycota but citing as synonymous “*M. prasiosmus* (Fr.: Fr.) Fr. ss. auct.” Included was “occasional in temp.-hemib., very rare in southern bore.”

Redhead (1982) reported that stipe cortical tissue (as “pigmented hyphal walls”) of *Marasmius copelandii* (later re-identified as *M. salalis*) produced a greenish gray to blue-green pigment in KOH solution. These reactions were also reported for *Marasmius olidus* and *M. prasiosmus*. We have been unable to confirm this report in the present study, but if Redhead’s concept of *M. prasiosmus* followed that of Kauffman (see supplementary data): it is not the European *M. prasiosmus*. Moreover, later research has proposed *M. olidus* to accommodate *M. prasiosmus* ss Kauffman.

**Specimens examined.** Czech Republic, Moravian Karst, Brno-Líšeň, Hádecká planinka, 1 Nov. 2001, coll. V. Antonín (as *Mycetinis querceus*), VA 01.340 (BRNM 666586); Moravia, Lipůvka, Dubová hora, 28 Oct. and 12 Nov. 1960, coll. F. Šmarda s.n. (as *Mycetinis querceus*) (BRNM 314016). Sweden, Uppland, Uppsala parish, Bondkyrka parish, Eriksberg, forest between Granitvägen and Hågaån, 21.X.1974, coll. S. Ryman (as *Marasmius prasiosmus*), SR 3241 (UPS-F-740438); Uppland: Uppsala parish, Bondkyrka parish, Kvarnbo lund, 12.XI.1974, coll. Svengunnar Ryman (as *Marasmius prasiosmus*). SR 3281, (UPS-F-740439); Uppland, Gamla Uppsala Parish, Fullerö backar (3 km N of the church), 13.X.2001, coll. N. Lundqvist (as *Marasmius prasiosmus*), NL 21502 (UPS-F-740442); Västergötland: Mölndal Parish, Gummelbo [N57°30'00", E12°01'00"], 5.X.1940, coll. T. Nathorst-Windahl, No. 2313, Fungi Exsiccati Suecici, Praesertim Upsaliensis [FES as *Marasmius prasiosmus*], no. 1155 (S, BPI and other presumed distributions; neotype); Västergötland, Vänershögs parish, Botered, X.1860, coll. G. Linnarsson (as *Marasmius prasiosmus*), s.n. (UPS-F-574708); Västmanland, Västerås-Barkarö parish, Ridön, Munkkällan, 12.X.1986, coll. Herbert Kaufmann (as *Marasmius prasiosmus*), s.n. (UPS-F-02106).

## 10. *Mycetinis salalis* (Desjardin & Redhead) Redhead., 2012. Index Fungorum 8: 1.

**Basionym:** *Marasmius salalis* Desjardin & Redhead. 1987. Mycotaxon 29: 308.

**Holotype.** Canada, British Columbia, Vancouver Island, Gordon Bay, Lake Cowichan, N48°49'35", W124°03'14", 4.X.1979, coll. S.A. Redhead, DAOM 175254 (DAOM).

**Diagnosis.** 1) Basidiomata small but robust (pileus 12–16 mm broad; stipe 33–46 × 1–3 mm); 2) spores 15–19 × 3.2–5.1 µm; 3) fruiting habit on fallen leaves of *Gaultheria* and *Berberis*; 4) stipe insititious, white upward, brick red downward; distribution from northern California to British Columbia.

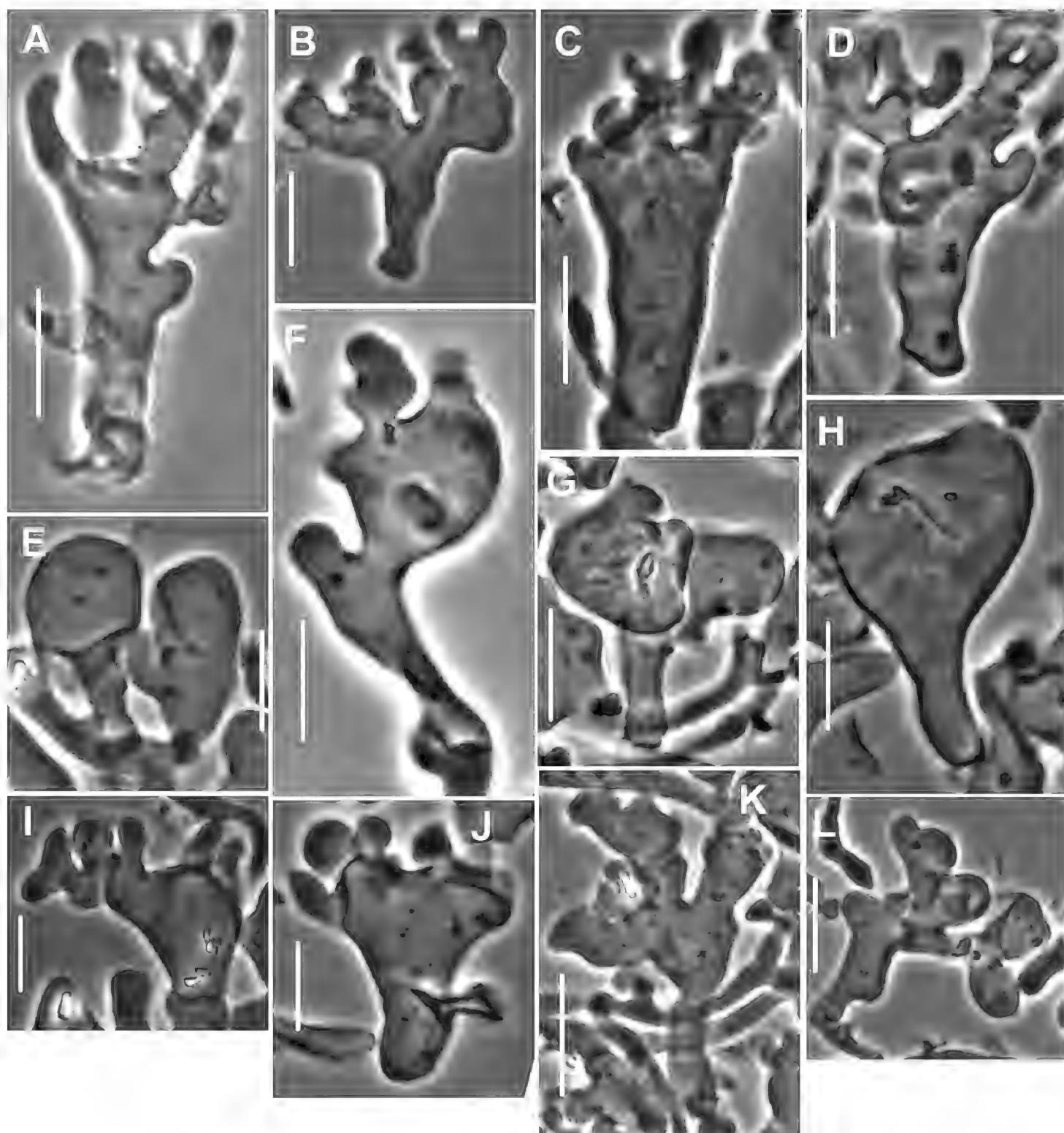


**Figure 64.** *Mycetinis salalis*. Photo in natural habitat. Photo courtesy of Steve Trudell. WTU-F 9803.

**Description.** **Basidiomata** (Fig. 64) small but robust. **Pileus** 12–16 mm wide, convex to plano-convex, somewhat radially furrowed with age to subtly sulcate-striate, moist, translucent-striate, disc “Saccardo’s umber” 5E8, outward “pinkish buff” 6A3 to “pale pinkish buff” 6A2, with paler marginal areas; margin often scalloped; context concolorous, membranous-tough. **Lamellae** adnate to adnexed, whitish to buff, “til-leul buff” 7B2, moderately spaced and sized, thickish, crenulate and paler on edges, exhibiting necropigment to near “cinnamon buff” 6B4, and characteristically crisped; lamellar edge minutely pruinose to entire, concolorous with lamellar face; lamellulae in 2 tiers. **Stipe:** 33–46 mm long, 1–3 mm wide, equal or with slightly swollen base, hollow, dry, upward villose to silky, downward sparsely to densely tomentose, becoming hispid with synnemata of stiff, dark caulocystidia up to 1 mm long, apically concolorous with lamellae, downward dark brick, chestnut, “bister” 5F8 to “benzo brown” 9D3 to “fuscous black” 6F4, insititious. **Rhizomorphs** uncommon, scattered, of two types: 1) resupinate on leaf surfaces, without evidence of origin or termination, 0.6–0.8 mm broad, flattened/strap-shaped, occasionally producing a stellate attachment; and 2) aerial, 3–14 × 0.1–0.3 mm (very slender), unbranched, curly. **Odor** strong of onion or garlic; **taste** strongly of onion or sweet garlic.

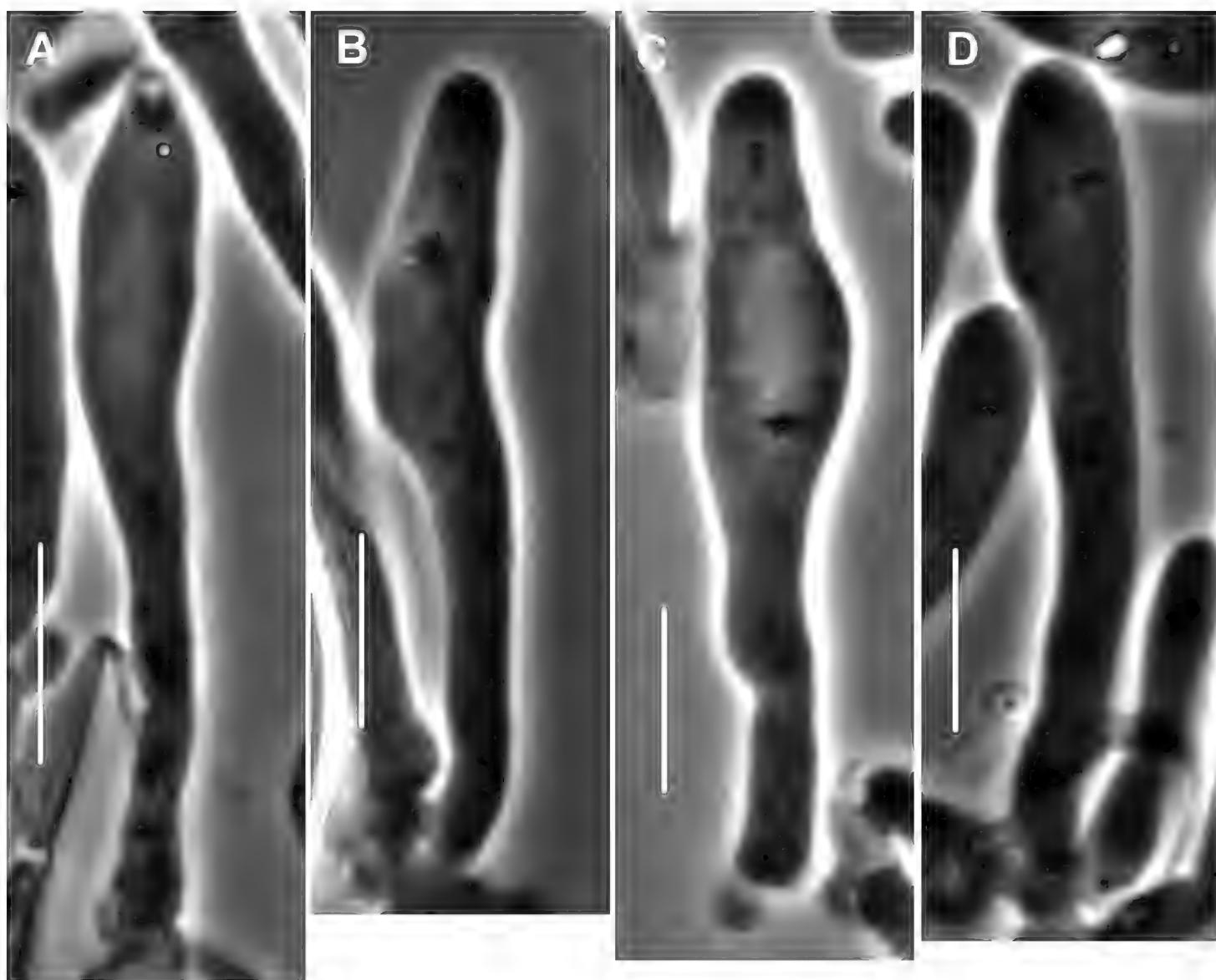
**Habitat and phenology.** Scattered on senescent leaves and branches of *Gaultheria shallon* Pursh and unidentified broad leaves in open forests of *Pseudotsuga menziesii* and *Tsuga heterophylla*; northern California to southern British Columbia; Autumn.

**Pileipellis** constructed of two elements: 1) inflated hyphal termini (Fig. 65E–L), 24–45 × 17–32(-40) µm overall, stalked (stalk 7–18 × 5–7.5 µm), subglobose, utriform,



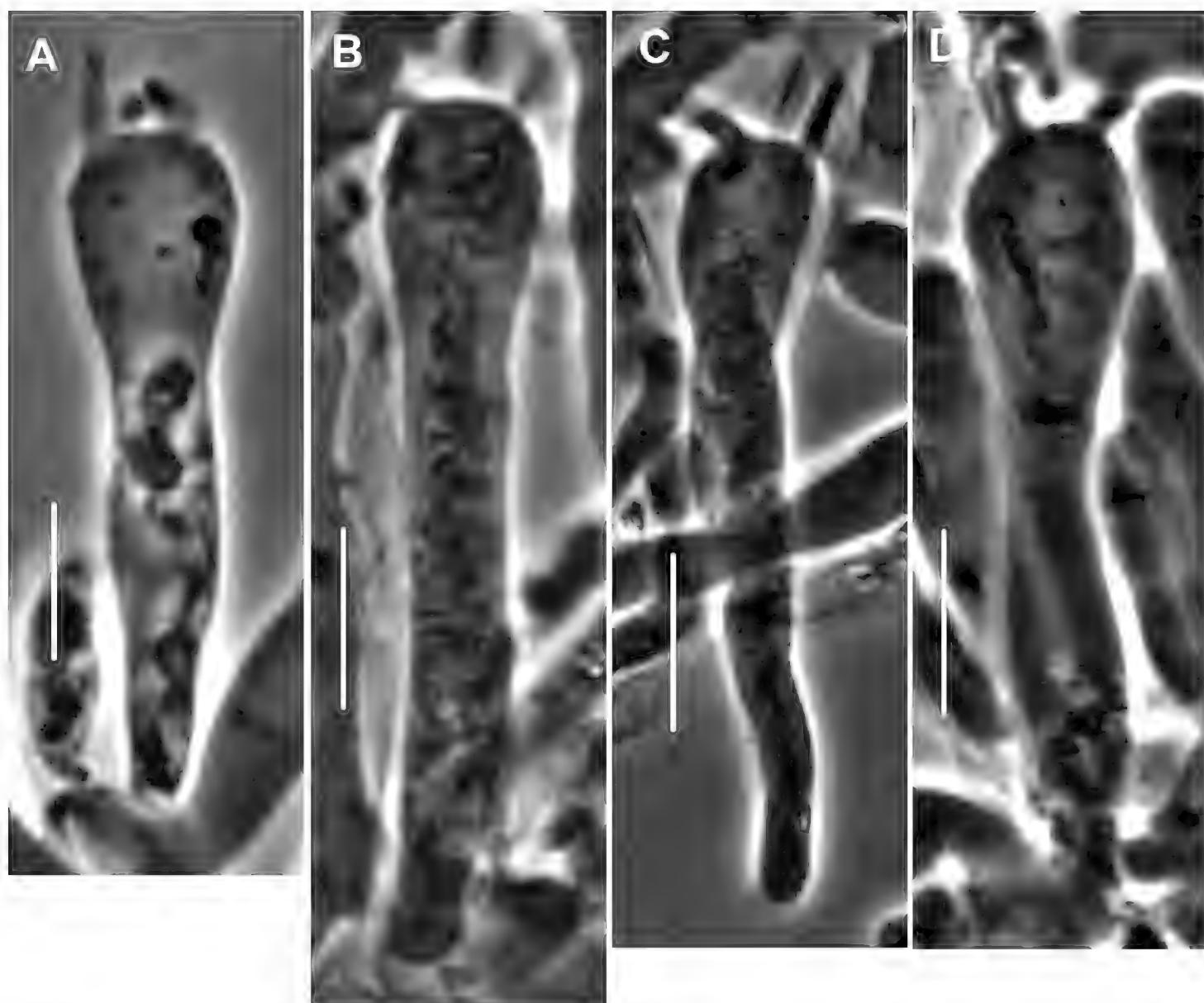
**Figure 65.** *Mycetinis salalis*. Pileipellis elements. **A–D, F** Pileocystidia **E, H** Inflated elements without growths **G, I–L** Inflated elements with free-form, lobose outgrowths. Standard bars = 10  $\mu\text{m}$ . TFB 5724 (TENN 52572).

or (usually) with irregular lobose or free-form configurations, firm- to thick-walled (wall ~1.5  $\mu\text{m}$  thick, and then sometimes pigmented in yellowish or ochraceous tints; and 2) pileocystidia (Fig. 65A–D) 30–48  $\times$  25–30 overall, stalked (stalk 10–25  $\times$  7–9  $\mu\text{m}$ ), firm- to thick-walled (wall ~0.7  $\mu\text{m}$  diam, hyaline), distally slightly inflated and beset with thick, digitate or gnarled outgrowths. Pileus and lamellar tramae loosely interwoven; hyphae 5–12  $\mu\text{m}$  diam, clamped, smooth, thin- to firm-walled, nonamyloid. **Pleurocystidia** (Fig. 66) (32-)37–50  $\times$  5–9  $\mu\text{m}$ , narrowly fusiform to fusiform, conspicuously clamped; contents homogeneous. **Basidia** (Fig. 67) (32-)41–55  $\times$  8–12  $\mu\text{m}$ , narrowly clavate, often subcapitulate, 4-sterigmate, conspicuously clamped; contents heteroge-



**Figure 66.** *Mycetinis salalis*. Pleurocystidia. Standard bars = 10  $\mu\text{m}$ . TFB 5724 (TENN 52572).

neous, multiguttulate also with oily inclusions (PhC). **Basidiospores** (Fig. 69A) (15-)16–18.5(-19)  $\times$  (3.5-)4–5  $\mu\text{m}$  ( $Q = 3.00$ –4.75;  $Q^m = 3.83$ ;  $L^m = 16.8 \mu\text{m}$ ), narrowly pip-shipped, clavate to curved-clavate, marasmioid (tapered proximally), thin-walled, inamyloid; contents heterogeneous, multiguttulate. Lamellar edge apparently sterile, lined with cheilocystidia. **Cheilocystidia** (Fig. 68) (25-)45–84  $\mu\text{m}$  long, stalked [stalk 15–35  $\times$  3–6.5  $\mu\text{m}$ , obscurely clamped, firm- to thick-walled (wall ~1.0  $\mu\text{m}$  thick)], somewhat expanded distally (9–14  $\mu\text{m}$  broad), ranging from clavate with no outgrowths to clavate with apical lobose outgrowths to distally branched; branches stout, 5–50  $\times$  2.5–5.5  $\mu\text{m}$ , ascending, often rebranched, rounded at apex. **Stipe medullary hyphae** 2.5–6.5  $\mu\text{m}$  diam, strictly parallel, tightly packed, free (without slime matrix), thin- to firm-walled, obscurely clamped. **Stipe cortical hyphae** 3–6.5  $\mu\text{m}$  diam, strictly parallel, free (without slim matrix), firm- to thick-walled (wall ~0.7  $\mu\text{m}$  thick, subhyaline), obscurely clamped, immediately turning dull olive ("buffy olive" 3E6, "yellowish olive" 2E5) in 3% KOH solution. **Caulocystidia from upper stipe** (Fig. 69B) 15–>500  $\times$  5–15  $\mu\text{m}$ , supple, subsinuous, thick-walled (wall 0.7–2  $\mu\text{m}$  thick, subhyaline, rarely occluding cell lumen), broadly attached to surface cortical hyphae. **Caulocystidia from stipe base** 25–>1000  $\times$  5–14  $\mu\text{m}$ , erect, stiff, setoid, thick-walled [wall 0.7–2(-4)  $\mu\text{m}$  thick, often occluding cell lumen, pigmented pallid yellowish].

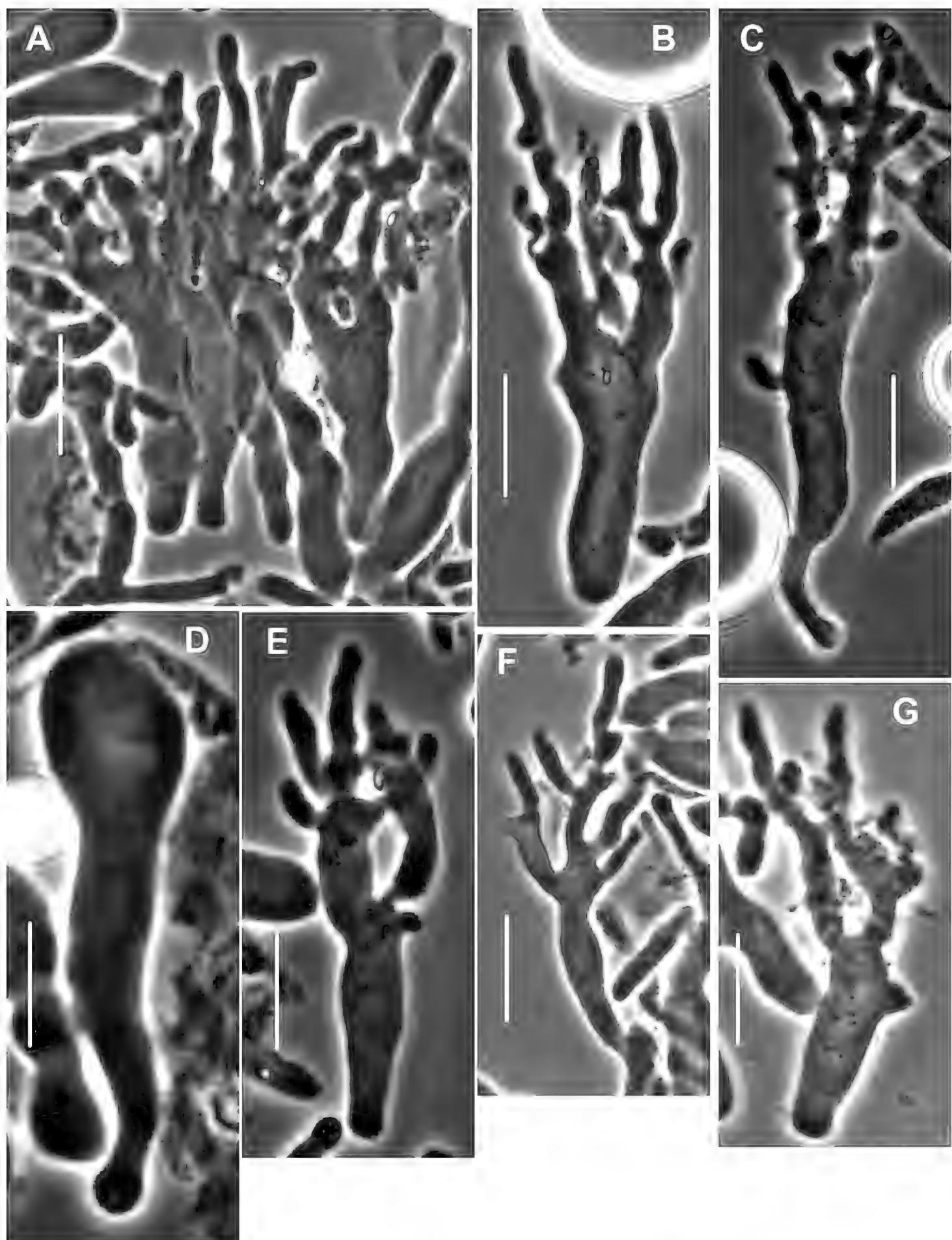


**Figure 67.** *Mycetinis salalis*. Basidia. Standard bars = 10  $\mu\text{m}$ . TFB 5724 (TENN 52572).

**Commentary.** Desjardin (1987a) and Desjardin and Redhead (1987) reported collections of *M. salalis* from British Columbia and Washington (apocryphal from Oregon) but not California. A single collection (TFB 8084 = TENN55408) from Trinity Co., California, produced ITS sequence nearly identical to those of *My. salalis* from farther north, as well as characteristic cheilocystidia, but spores significantly shorter [(10-)12–13(-14)  $\times$  3–4  $\mu\text{m}$  ( $Q = 1.8\text{--}4.33$ ;  $Q^m = 3.36$ ;  $L^m = 12.3 \mu\text{m}$ )] than those of *My. salalis*. TFB 8084 was initially identified as *M. copelandii* based on spore statistics, but molecular evidence confirmed that it was conspecific or closely related to *My. salalis*. ITS sequences are presently unavailable for authentic *My. copelandii* for comparison.

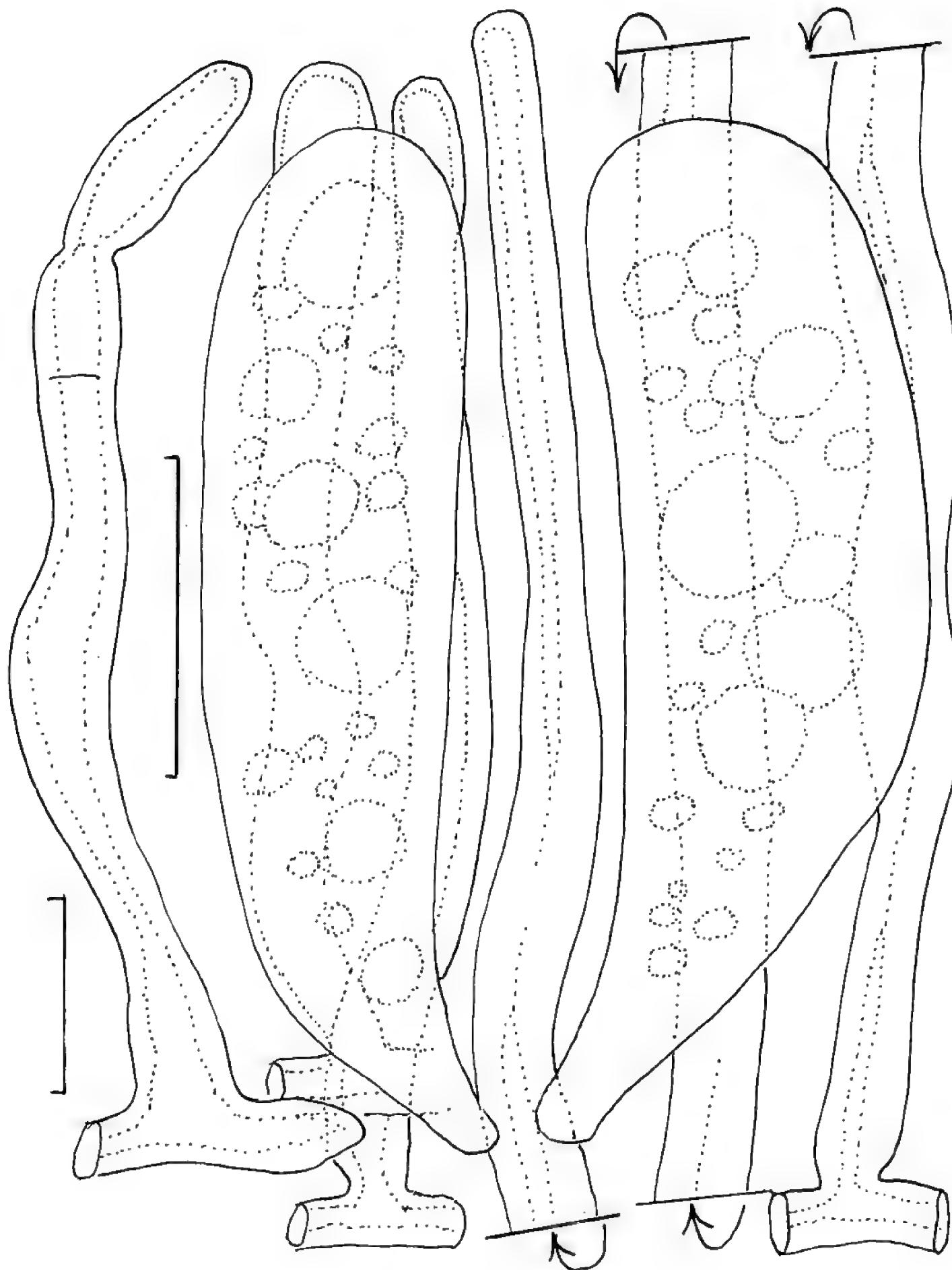
Pleurocystidia in *My. salalis*, as in other taxa of *Mycetinis*, are difficult to distinguished from basidioles. Separation has been made on the following characters: 1) consistent narrowly fusiform shape versus consistent subcapitulate-clavate basidiole shape; 2) homogeneous contents (PhC), usually with a single distal dark inclusion, versus multiguttulate heterogeneous contents of basidioles.

Cheilocystidia in *My. salalis* closely resemble pileocystidia. In neither structure can the branches be termed as setulae, which are considered as significantly smaller in



**Figure 68.** *Mycetinis salalis*. Cheilocystidia. **A** Cluster of cheilocystidia **B, C, E–G** Individual branched cheilocystidia **D** Clavate, unornamented element. Standard bars = 10  $\mu\text{m}$ . TFB 5724 (TENN 52572).

length and breadth. Cheilocystidia of *My. salalis* resemble pileocystidia of *My. scorodonius*, but cheilocystidia of the latter are more complex, with ultimate outgrowths shorter and more slender.



**Figure 69.** *Mycetinis salalis*. **A** Basidiospores. **B** Caulocystidia: left from upper stipe, right from lower stipe. Standard bars: **A** = 5 µm, **B** = 20 µm. TFB 5724 (TENN 52572).

Basidiospores of *My. salalis* are significantly longer than those of *My. copelandii*. Collection TENN-F-55408-TFB 8084 (morphologically *My. copelandii*) is characterized by appropriately shorter spores but its ITS sequence is essentially congruent to

those of *My. salalis* (0.2% divergence from *My. salalis* collections DAOM175251 and WTU9803; Fig. 2). This collection, therefore, appears enigmatic. The situation may be resolved when additional ITS sequences become available for *My. copelandii* and/or when multigene trees can be produced.

Redhead (1982): "The change to greenish grey of the pigmented hyphal walls and the blue green plaque in KOH is reminiscent of such reactions in *Collybia* species allied to *C. alkalivirens* Singer (see Halling. Mycotaxon 8: 453-458. 1979). These reactions also occur in *Marasmius*, *Mycetinis olidus* and *Marasmius*, *Mycetinis prasiosmus*."

**Specimens examined.** United States, California, Trinity Co., Rte 299, Grey's Point Campground, N40°56'55", W123°53'47", 15.XI.1996, coll RHP, det. D. Largent (as *M. copelandii*), TFB 8084 (TENN55408). Washington, King Co., vic. Greenwater, Federation Forest State Park, N47°09'20.21", W121°42'10.98", 3.X.1992, coll RHP, TFB 5724 (TENN52572); Mason Co., Shelton, Shelton Point, N47°13'05", W123°06'58", 25.X.1966, det. K. Harrison (as *Marasmius scorodonius*), Stz 13741 (WTU-F-9219); Pierce Co., Mount Rainier National Park, Hwy 123, 3.3 miles south of 123/410 junction, N46°49'28.96", W121°32'41.75", 5.X.1997, coll & det S. Trudell (as *Mi. perforans*), Trudell 97-278-17 (WTU-F-009308); Whatcom Co., vic. Bellingham, Silver Lake area, N48°58'16.8", W122°04'05.2", 10.X.1992, coll Coleman McCleneghan, TFB 5822 (TENN52249).

## 11. *Mycetinis scorodonius* (Fr.: Fr.) A.W. Wilson & Desjardin., 2005. *Mycologia* 97: 678.

≡ *Agaricus scorodonius* Fr. 1815. Observ. Mycol. 1: 29.]

≡ *Agaricus scorodonius* Fr. 1821. Syst. Mycol. 1: 130.

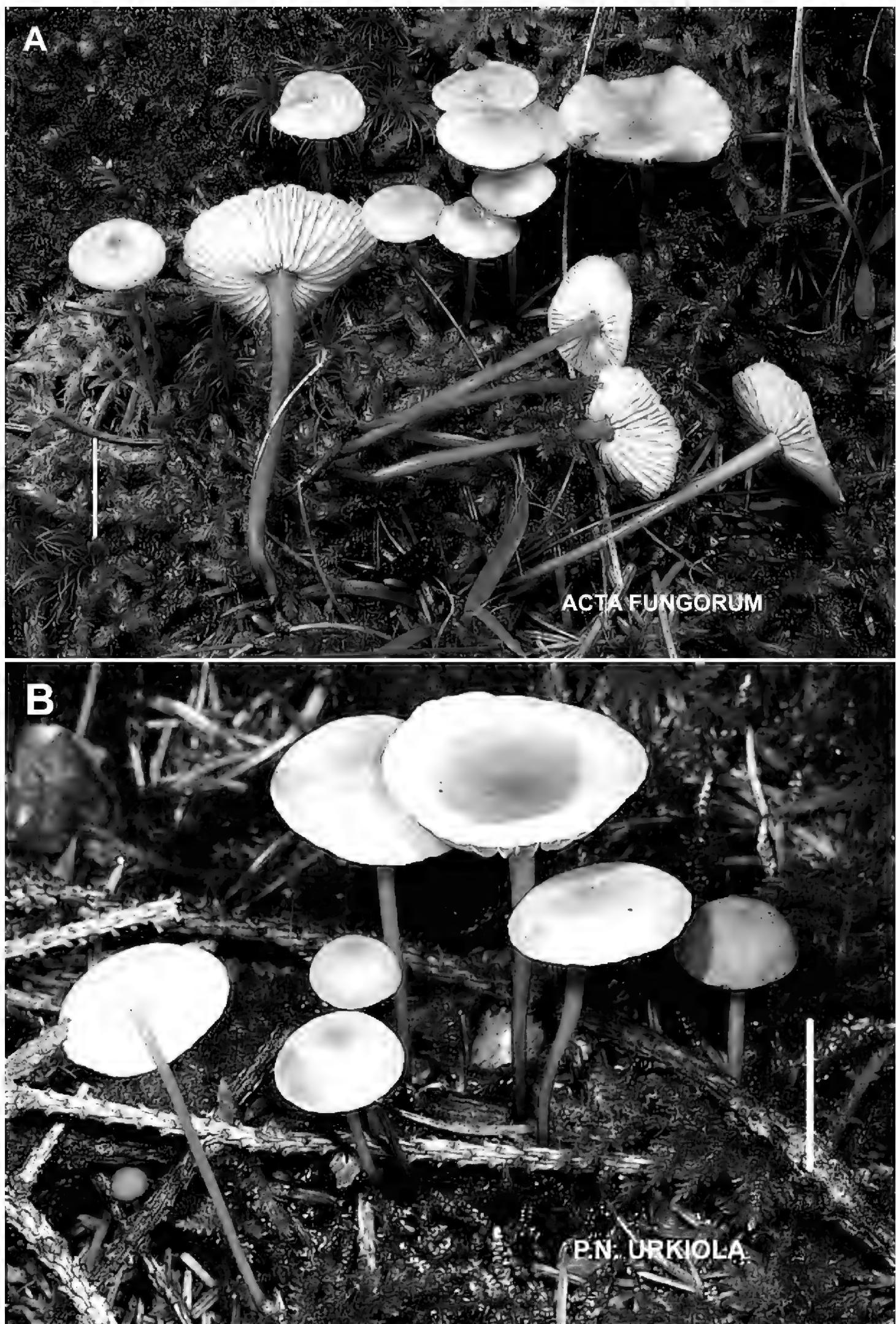
≡ *Marasmius scorodonius* (Fr.) Fr. 1838. Epicrisis 379.

≡ *Gymnopus scorodonius* (Fr.) J.L. Mata & R.H. Petersen. 2004. Mycoscience 45: 221.

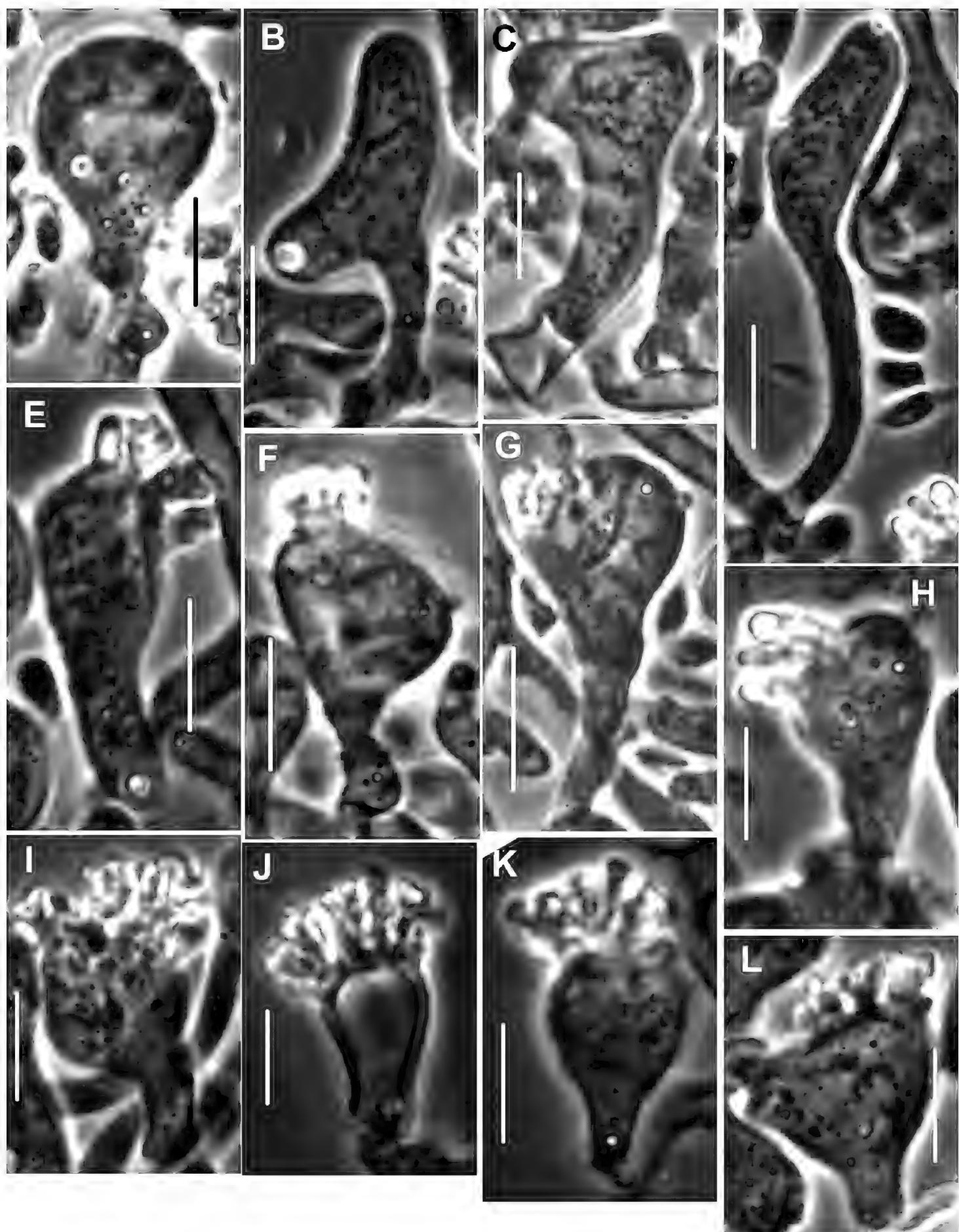
**Type specimen** (neotype, design. Antonín and Noordeloos 1993). *Fungi Exsic. Scandinavia*, no. 1 (Sweden, Stockholm, Autumn, 1889, coll. A. Romell (BR; isoneotypes B, BP, W)).

**Diagnosis.** 1) Basidiomata of moderate size (pileus 10–30 mm broad; stipe 40–60 × 0.5–1.3 mm); 2) stipe brown or orange brown upward, midsection off-white, downward mahogany to red-brown, glabrous; 3) pileipellis at pileus margin with inflated hyphal termini and broom cell-like cells; 4) spores ellipsoid to amygdaliform,  $L^m = 9.0 \mu\text{m}$ ; 5) strong garlic odor and taste; 6) distribution in Europe and North America (rare on North American west coast).

**Description.** **Basidiomata** (Fig. 70) of moderate size. **Pileus** (3-)10–30 mm broad, almost hemispherical when young, convex with slightly raised disc, then convex to almost applanate, even to slightly depressed on disc, smooth, glabrous to sub-glabrous, hygrophanous; disc neutral brown, "sayal brown" 6C5, "cinnamon" 6B5,

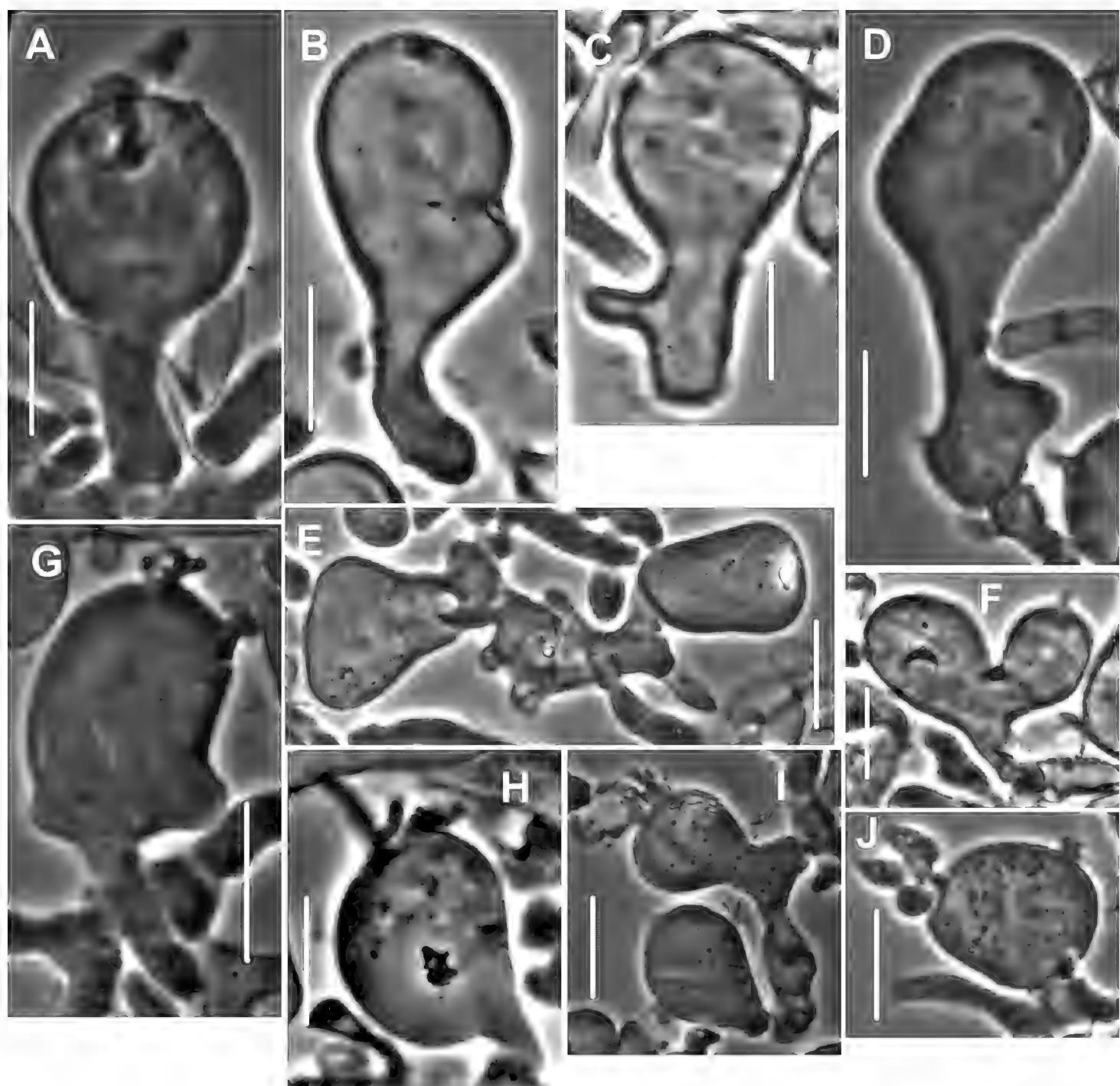


**Figure 70.** *Mycetinis scorodonius*. Basidiomata. Standard bars = 20 mm. **A** Courtesy Acta Fungorum  
**B** Courtesy P.N. Urkiola.



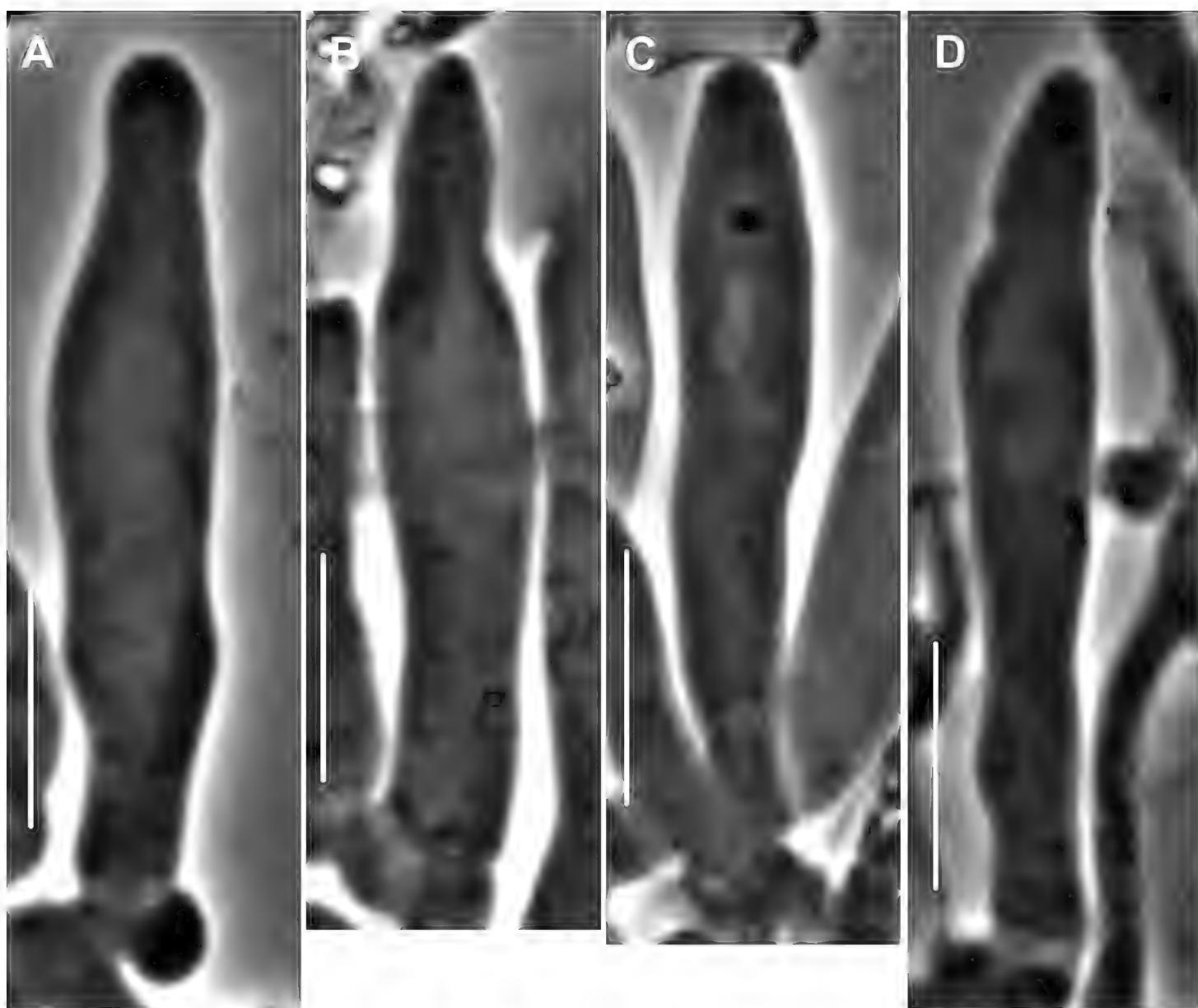
**Figure 71.** *Mycetinis scorodonius*. Pileus margin pileipellis elements. **A–D** Inflated elements **E–L** Broom cell-like elements. Standard bar = 20 mm. TFB 14229 (TENN-F- 68086).

brownish orange 6C4, when moist brown, yellow-brown or ochre, sometimes paler towards margin; margin slightly involute then more or less straight, undulating, distinctly pallescent on drying to pale brown 6D5, pale ochraceous, “pale ochraceous buff” 4A2, “pale pinkish cinnamon” 6A2, pinkish, “pinkish buff” 6A3, or dirty white,



**Figure 72.** *Mycetinis scorodonius*. Inflated pileipellis elements. **A–F** Structures without outgrowths **G–J** Structures with digitate to lobate outgrowths. Standard bars = 10 µm. TFB 13746 (TENN-F- 65123).

smooth or slightly radially rugulose, even subsulcate when old. **Lamellae** adnexed to adnate to a thin pseudocollarium which becomes most visible with lamellar secession in drying, subdistant, close to crowded, total lamellae 38–48, through lamellae 15–20 (in robust form total lamellae 72–97, through lamellae 27–32), slightly intervenose when old, narrow (lamellae ~1.5 mm broad); white to orange white 5A2, near “pale ochraceous buff” 4A2, “pale pinkish cinnamon” 6A2 to off-white when fresh; frequent necropigment upon drying and storage to dusky cantaloupe color with a hint of pink to make “light ochraceous buff” 5A4 to “pinkish buff” 6A3; lamellulae in at least two ranks, often rudimentary; lamellar edge concolorous with lamellar face, minutely pruinose. **Stipe** (15-)40–60 × 0.5–1.5(-3) mm, terete to slightly compressed, often slightly broadened apically, sometimes tapering gradually downward, hollow, often appearing insititious, but usually with poorly developed basal disc or basal mycelium,

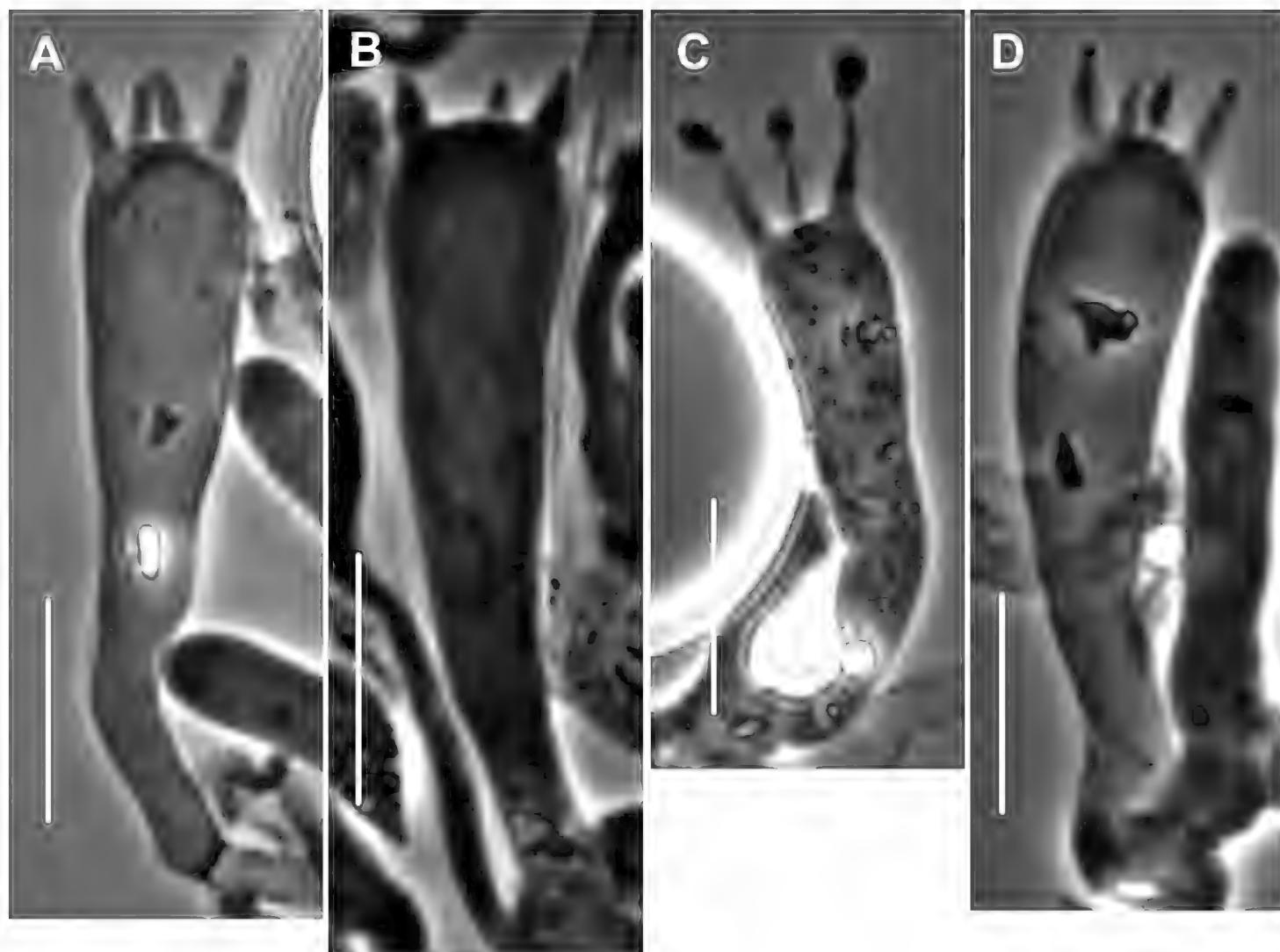


**Figure 73.** *Mycetinis scorodonius*. Pleurocystidia. Standard bars = 10  $\mu\text{m}$ . TFB 7261 (TENN-F-53568).

glabrous to sometimes delicately pruinose at apex only, pallid to pale brown at apex, “tilleul buff” 7B2, drying to “cinnamon buff” 6B4, brownish orange 6C4, downward off-white becoming brown, “sayal brown” 6C5, dark reddish brown 7F8, mahogany, “Verona brown” 6E5, or orange-brown, “Brussels brown” 6E6, “Mikado brown” 7C6, “mummy brown” 6F8 towards base, with fine rusty tomentum at base. Context thin, white to pale brown. **Rhizomorphs** not reported. **Odor** weak to strong of garlic, rarely lacking; **taste** usually alliaceous.

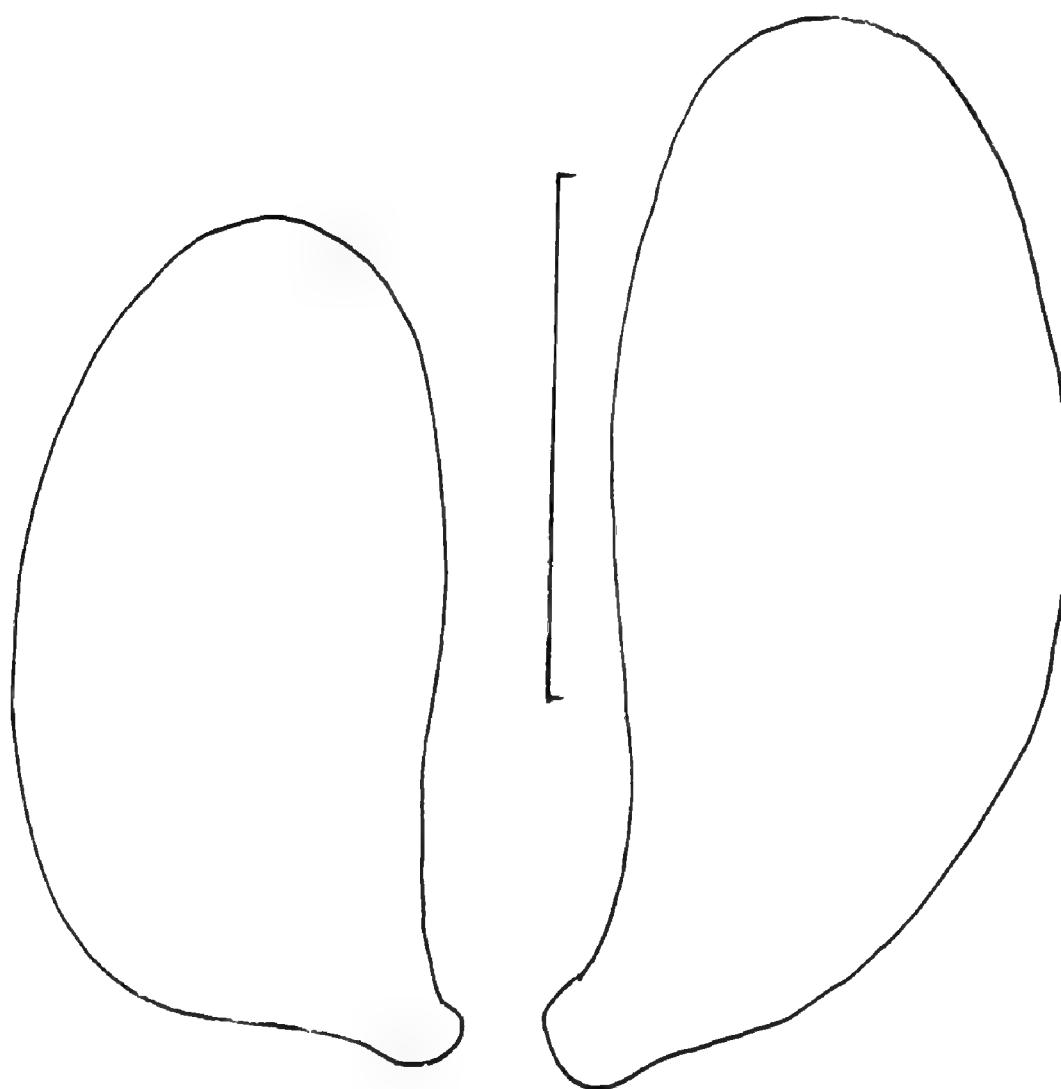
**Habitat and phenology.** Clustered to gregarious, not fastidious of substratum for fruiting, coniferous needles, various dead deciduous leaves from forest trees (*Fagus*, *Quercus*, *Alnus*, *Acer*, etc.) and heaths; widely distributed through Europe including western Russia, Scandinavia, northern Africa and eastern North America (see Antonin and Noordeloos 2010), reported as rare in California; Autumn.

**Pileipellis at pileus margin** a mixture of three major structures: 1) roughly hymeniform layer of inflated cells (Figs 71A–D, 72A–F) (16-)33–40(-45)  $\times$  14–23  $\mu\text{m}$  overall, thick-walled (wall ~1.5  $\mu\text{m}$  thick, hyaline, smooth or minutely roughened, stalked (stalk 7–20  $\times$  3.5–5.5  $\mu\text{m}$ ), clamped; 2) similar inflated termini, overall 33–47  $\times$  14–33  $\mu\text{m}$  overall, stalked (stalk 12–18  $\times$  3.5–6  $\mu\text{m}$ , clamped), usually expanded distally and



**Figure 74.** *Mycetinis scorodonius*. Basidia. Standard bars = 10  $\mu\text{m}$ . TFB 7261 (TENN-F-53568).

then beset by complex lobate to diverticulate processes (Fig. 72G–J); diverticula papillate, fin-like, lobate to digitate, -9  $\mu\text{m}$  long, subrefringent (PhC); and 3) differentiated broom cell-like pileocystidia (Fig. 72E–L) 21–28  $\times$  8–16  $\mu\text{m}$  overall, stalked (stalk 3–8  $\times$  3.5–5.5  $\mu\text{m}$ ), somewhat swollen distally, thick-walled throughout, surmounted by a cluster of outgrowths; outgrowths digitate to catenulate, hyper-refringent (PhC), often knobbed at apex, occasionally dichotomous. **Pileipellis over pileus disc** constructed of two hyphal types: 1) a coarse hymeniform layer composed of clavate, pyriform, utriform, vesiculose, sometimes slightly fusiform or lobate elements, (5.0-)20–42(-58)  $\times$  13–24(-35)  $\mu\text{m}$ , smooth or less frequently with a few digitate apical projections (not true broom cells) up to 6  $\mu\text{m}$  long, or only somewhat apically roughened, thin- to thick-walled (wall up to 1.5–2.0  $\mu\text{m}$ , hyaline to yellow-brown); and 2) free-form hyphal termini, coarsely complexly lobed, stalked (stalk 5–12  $\times$  4–6  $\mu\text{m}$ ), overall 15–30  $\times$  17–40  $\mu\text{m}$ ; individual lobes and hyphae 5–8.5  $\mu\text{m}$  diam, thin- to firm-walled; contents heterogeneous. Pileus and lamellar tramae loosely interwoven; hyphae of two types: 1) 3–7.5  $\mu\text{m}$  diam, firm-walled, conspicuously clamped; and 2) 3.5–9  $\mu\text{m}$  diam, thin- to firm-walled, conspicuously clamped; contents heterogeneous. **Pleurocystidia** (Fig. 73) 31–40  $\times$  5–7  $\mu\text{m}$ , cylindrical to narrowly fusiform, acutely rounded at apex, conspicuously clamped; contents more or less homogeneous. Subhymenial hyphae branched, cylindrical, hyaline, 2.0–5.0  $\mu\text{m}$  wide, clamped. Basidioles clavate, cylindrical to subam-

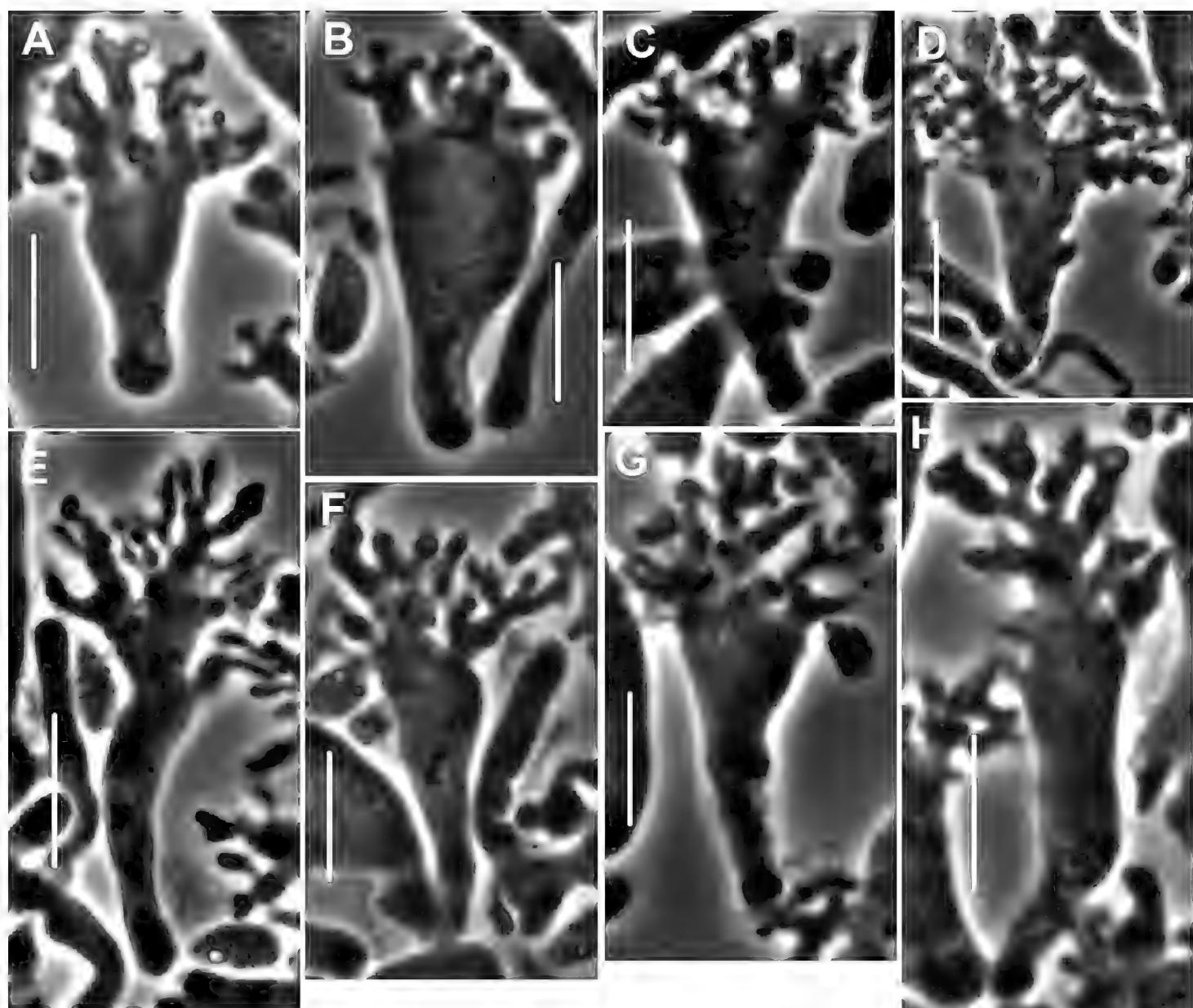


**Figure 75.** *Mycetinis scorodonius*. Basidiospores. Standard bar = 5  $\mu\text{m}$ . TFB 7261 (TENN-F- 53568)

pulliform, obscurely clamped; **basidia** (Fig. 74)  $28\text{--}42 \times 7.0\text{--}9.0 \mu\text{m}$ , clavate to subcapitulate, (2-)4-sterigmate, obscurely clamped; contents heterogeneous, multiguttulate. **Basidiospores** (Fig. 75)  $(6.5\text{--})8.0\text{--}10.0(-11.0) \times (3.5\text{--})4\text{--}4.5(-5.5) \mu\text{m}$  ( $Q = 1.55\text{--}2.57$ ;  $Q^m = 1.93$ ;  $L^m = 9.0 \mu\text{m}$ ), ellipsoid, ovate to amygdaliform, smooth, thin-walled, inamyloid; contents heterogeneous, minutely multiguttulate. **Cheilocystidia** (Fig. 76) locally plentiful, *siccus*-type,  $(12\text{--})23\text{--}40 \times 14\text{--}21 \mu\text{m}$  overall, staked (stalk  $12\text{--}24 \times 3\text{--}5.5 \mu\text{m}$ , obscurely clamped), often inflated distally, surmounted with a complex of diverticula; diverticula  $2\text{--}10 \times 1\text{--}1.5 \mu\text{m}$ , gnarled, often dichotomous. Stipitipellis a cutis of  $3.0\text{--}12.0 \mu\text{m}$  wide, cylindrical hyphae with yellow-brown to dark brown, slightly thickened ( $-2.0 \mu\text{m}$ ) walls. **Caulocystidia** not differentiated, but sometimes scattered, cylindrical, terminal endings of cortex hyphae present.

**Commentary.** Description of pleurocystidia may be somewhat miscast. Traditionally, pleurocystidia and basidioles have been confused. The description above is based on the following circumstances: 1) more acutely rounded pleurocystidial apex than subcapitulate basidioles; 2) homogeneous pleurocystidial contents as compared with the heterogeneous contents of basidia and maturing basidioles; and 3) usual length of both structures not acceding that of basidia.

The marasmoid cheilocystidia were sought in three European collections (Belgium, Netherlands, Sweden) in at least two different mounts from two different basidi-

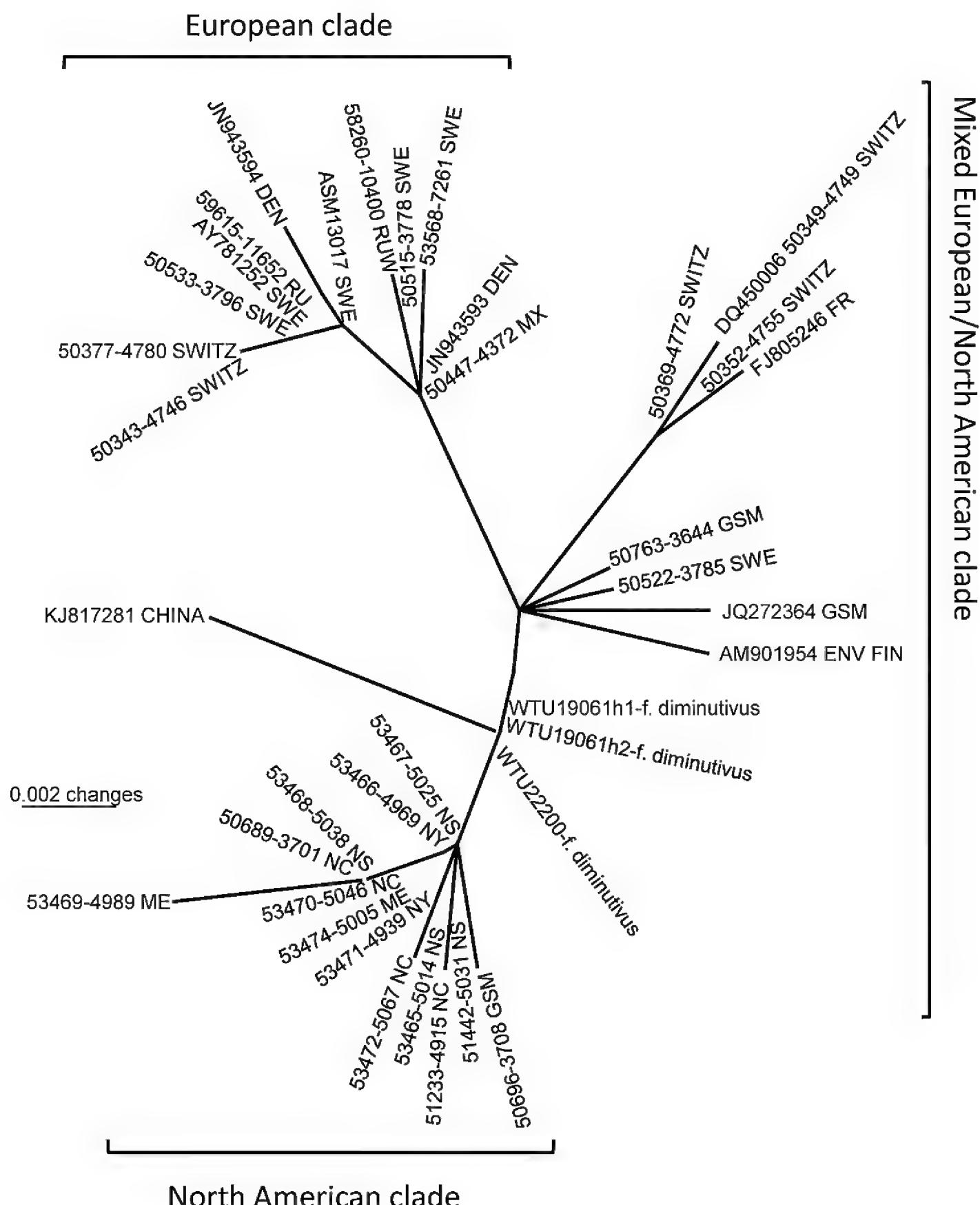


**Figure 76.** *Mycetinis scorodonius*. Cheilocystidia. Standard bars = 10  $\mu\text{m}$ . TFB 7261 (TENN-F-53568).

omata of each collection, so the sudden abundance of highly differentiated cheilocystidia in TFB 7261 was surprising. Moreover, the entire lamellar edge was covered and so was sterile. In other lamellar margins, only structures resembling the clavate shapes found in other species of *Mycetinis* were observed.

*Mycetinis scorodonius* may exist in two forms: 1) pileus -20 mm broad; 2) lamellae distant, narrow; 3) stipe slender (1–2.5 mm broad, terete), tapering downward; versus 1) pileus 15–32 mm broad; 2) lamellae crowded, well-developed; 3) stipe robust (2–4 mm broad, often compressed). These forms share the following: 1) strong odor and taste of garlic when fresh; 2) smooth pileus with brown disc and tan limb; 3) pileocystidia in pileipellis from pileus margin. To this writing (X.2016), the robust form has been seen from Belgium, Samara Region, Russia and North America; the slender form has been limited to the Leningrad Region, Russia.

There were sufficient ITS sequences to analyze population structure in *Mycetinis scorodonius* (Fig. 77). European and North American populations are not mutually exclusive. There is a distinct North American haplotype but European collections seem to be a mix of two haplotypes; one, a North American-like haplotype and one not found in North America termed “European-like” in Fig. 77. A single North American



**Figure 77.** *Mycetenitis scorodonius*. Unrooted PhyML of *My. scorodonius* collections based on the ribosomal ITS region.

collection has the European-like haplotype and a collection from Mexico is heterozygous for both European-like and North American-like haplotypes.

The origin of the two European haplotypes is uncertain but it would appear that some gene flow between Europe and North America has occurred, either by long distance spore dispersal or human mediation.

Gordon (1994) and Gordon and Petersen (1998) employed three methods in a taxonomic analysis of numerous pan-Atlantic collections of *My* (as *Marasmius*) *scorodonius*. Using basidiome collections and derived cultures of European and eastern North American specimens, collections were submitted to Numerical Taxonomy and Multivariate Analysis System (NTSYS-pc; (Rohlf 1992)) and UPGMA cluster analysis, pairing experiments using single-basidiospore isolates and laccase electrophoresis. Although some micromorphological variation was found (i.e. presence/absence of cheilocystidia), European and North American collections were intermixed, with no clear-cut separation detected. Likewise, pairing experiments indicated that European and eastern North American collections were sexually intercompatible, indicating a single biological taxon across the trans-Atlantic barrier. Laccase electrophoresis, however, clearly separated European versus eastern North American collections, indicating lack of long-distance genetic exchange across the oceanic barrier. Altogether, results were not incompatible with conclusions shown here by use of DNA sequences.

Although apparently rare, one specimen of *My. scorodonius* from Washington (state) has been examined. Another from California is reported in Mycoportal (Humboldt Co., Patrick's Point State Park, 25.IX.1968, coll. & det. HD Thiers, annot. DE Desjardin, SFSU-025263).

Basidiomata of *My. alliaceus* and *My. copelandii* do not exhibit differentiated pileocystidia. In *My. copelandii*, free-form cells accompany inflated hyphal termini, but in *My. alliaceus*, the inflated elements are the only element observed, although at pileus margin some individuals are found to produce apical outgrowths.

**Specimens examined.** **Belgium**, Dimpire, vic. Heer, Masembre, N50°09.360", E4°51.224", coll. KWH, TFB 13746 (TENN65123). **Canada**, Nova Scotia, Kejimkujik National Park, N44°22'44", W65°20'32", Rogers Brook Trail, 4.VIII.1992, coll SA Gordon, TFB 5031 (TENN51442); Kejimkujik Nat. Park, Grafton Lake Loop Trail, N44°22'55", W65°10'55", coll. SA Gordon, TFB 5038 (TENN-F-53468). **The Netherlands**, Gelderland Prov., Wageningen, N51°58'12", E5°39'54", 3.VIII.1959, leg. K. Bakker, det. C. Bas, LRH 23881 (TENN-F-23881). **Russia**, Leningrad Region, Dist. Lindylovskaye, Rocha Reserve, N60°14.30', E29°32.394', 25.VIII.1999, coll RHP, TFB 10400 (TENN58260); Samara Region, Zhijulevsky Reserve, vic. St. Nicholas Spring, Shirayev Valley, N53°23.425', E49°57.939', 17.VIII.2004, coll RHP, TFB 12168 (TENN-F-60107). **Sweden**, Uppland, vic. Uppsala, Tärnby Lund, N59°51'345", E17°38'05", 4.IX.1994, coll RHP, TFB 7261 (TENN-F-53568); Västergötland, Lillaedet, Myrtuvan, N58°08'30", E012°02'40", 19.IX.1991, coll/ SA Gordon et al., TFB 3796 (TENN-F-50533). **United States**, Georgia, Rabun Co., Rte 28, approx. 1 mi into GA, N34°57'11.32", W83°11'00.70", 1.VI.1993, coll RHP (as *M. copelandii* var. *olidus*), TFB 6213 (TENN52873); Maine, Hancock Co., Lamoine, N44°29'22", W68°18'35", 25.VII.1992, coll. SA Gordon & W. Litten, TFB 5005 (TENN-F-53474); Massachusetts, Berkshire Co., vic. North Adams, N42°42'03", W73°06'33", 16.IV.1986, coll. DE Desjardin, DED 4060 (TENN-F- 54179); Michigan, Marquette Co., Powell, vic. Ives Lake, N46°50'47",

W87°50'05", 28.VIII.1971, coll. RHP, TENN-F-036156; North Carolina, Macon Co., vic. Highlands, Nantahala Nat. For., Blue Valley, Pickelsimer's Falls Trail, N35°00'50", W83°14'39", 18.VII.1991, coll. SA Gordon., TFB 3701 (TENN-F- 50689); Tennessee, Blount Co., GSMNP, Cades Cove, Parsons Branch Rd., N35°33'44", W83°22'48", 14.IX.1987, coll DE Desjardin, DED4500 (TENBN-F-54182); GSMNP, Cades Cove, vic. Oliver cabin, N35°36'25.42", W83°47'39.03", 12.VI.2013, coll. RHP, TFB 14229 (TENN68086); Sevier Co., GSMNP, Greenbrier area, N35°42'28", W83°22'48", 19.VII.1986, coll. DE Desjardin, DED 3875 (TENN-F- 54209); GSMNP, Mt. LeConte, N35°39'18", W83°26'28", 4.VI.1957, coll. LR Hesler, TENN-F-009183. Washington, King Co., Seattle, Univ. Washington campus, N47°39'14.83", W122°18'28.53", 12.X.1942, coll. & det. DE Stuntz, STz 1239 (WTU-F-9221).

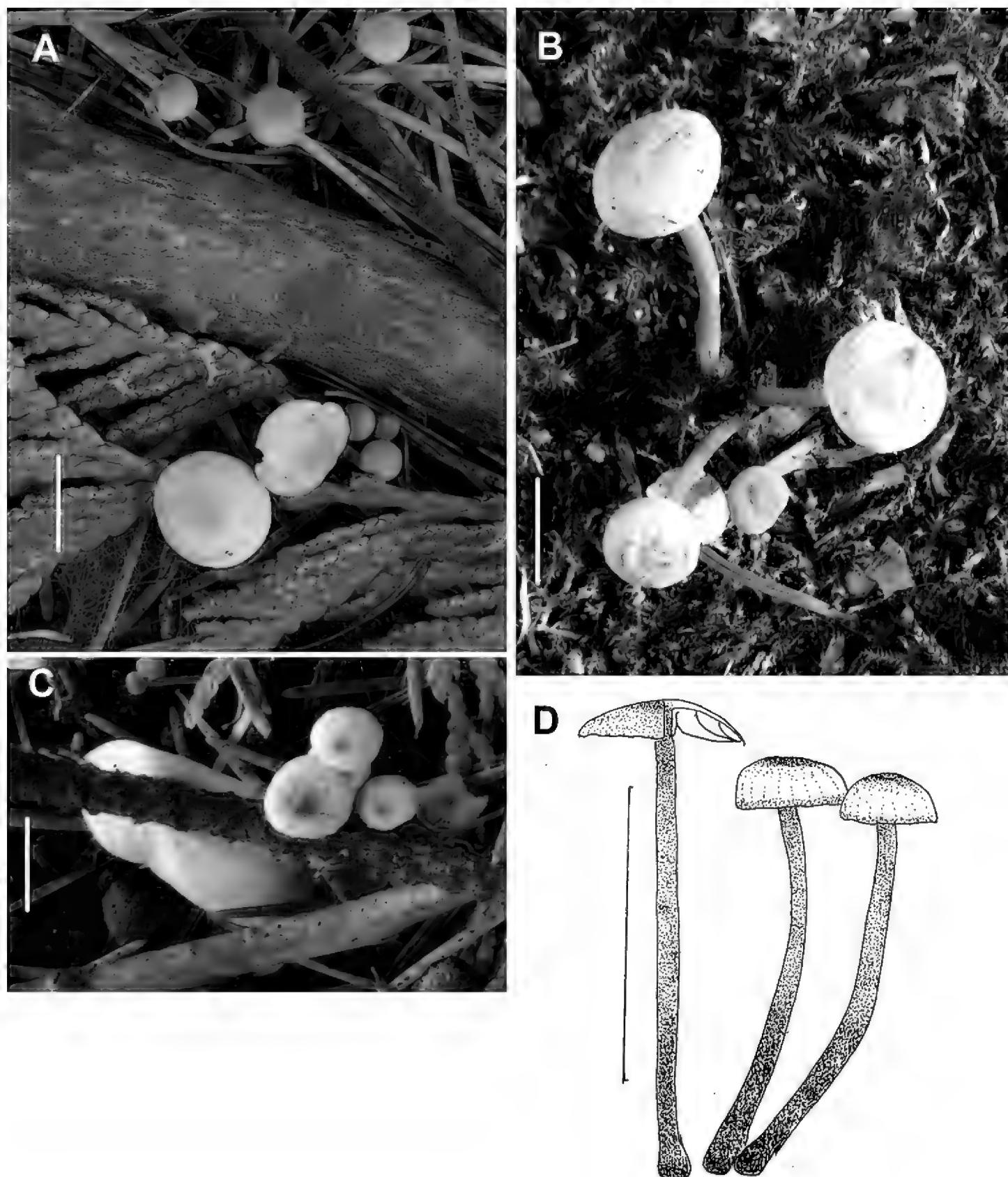
**11A. *Mycetinis scorodonius* f. *diminutivus* R.H. Petersen, K. Dyson & J. Ammirati, f. nov.**

Index Fungorum no. 553206

**Holotype.** United States, Washington, King Co., Bellevue, N47°34'55.91", W122°10'06.96", 4.XI.2015, coll. K. Dyson, KLD 2220-11-4-2015 (TENN69345),

**Diagnosis.** 1) Basidiomata diminutive (pileus 3–10 mm broad; stipe 10–33 × 0.8–1.5 mm); 2) stipe glabrous-shining, not at all vested; 3) pileipellis at pileus margin a combination of thick-walled inflated elements and arbuscular pileocystidia; 4) pileipellis over pileus disc a hymeniform layer of inflated hyphal termini, mostly thick-walled and hyaline, with scattered thicker-walled, pigmented individuals; 5) spores 8–9.5 × 3.5–4.5 µm ( $L^m = 8.65 \mu\text{m}$ ); 6) fruiting on soil or minute plant detritus in urban environments.

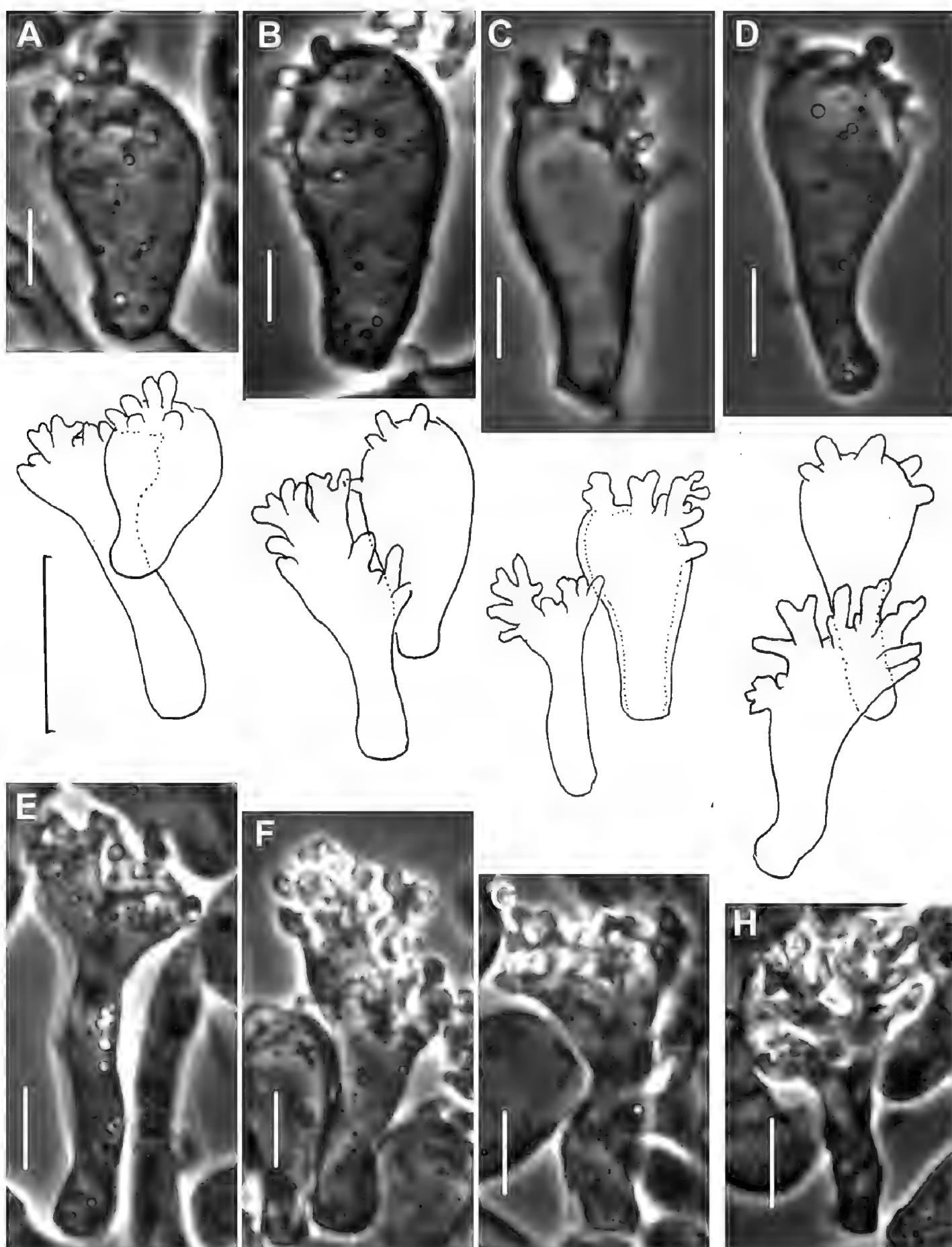
**Description.** **Basidiomata** (Fig. 78) diminutive, sparsely gregarious, often cespitose in small groups. **Pileus** 3–10 mm broad, strongly convex when young with strongly inturned margin, becoming shallowly convex to almost plane by maturity, sometimes shallowly and broadly umbonate, smooth, suede-like (not glabrous), near "sayal brown" 6C5, "cinnamon" 6B5 to "drab" 6D3 over disc, somewhat paler, "ochraceous buff" 5A5, "light grayish olive" 30B2, "tilleul buff" 7B2, "pale pinkish cinnamon" 6A2, over limb and margin, often somewhat radially puckered; margin inrolled when immature, downturned to gently downturned by maturity, entire with no evidence of striation. **Lamellae** adnexed to adnate, attached to a weak pseudocollarium not seceding with dried lamellae, well-developed (-1 mm broad), hardly ventricose, thickish, total lamellae 52–56, through lamellae 17–22, characteristically crisped when dried, probably off-white when fresh, "cartridge buff" 30A2 to "light buff" 3A2 when dried; lamellulae in 1–2 ranks. **Stipe** 10–33 × 0.8–1.5 mm, terete, more to less equal, gradually enlarged downward from midsection to base, insititious, glabrous-shining, not at all vested, apically near "tawny olive" 5C5, downward in midsection "ochraceous



**Figure 78.** *Mycetinis scorodonius* f. *diminutivus*. Basidiomata. **A** 22200-11-4-2015 **B** 10961-10-20-2015 **C** 22167-10-14-2015 **D** Reconstruction from dried specimen. Standard bars: **A-C** = 10 mm; **D** = 20 mm. **A-C** courtesy K. Dyson.

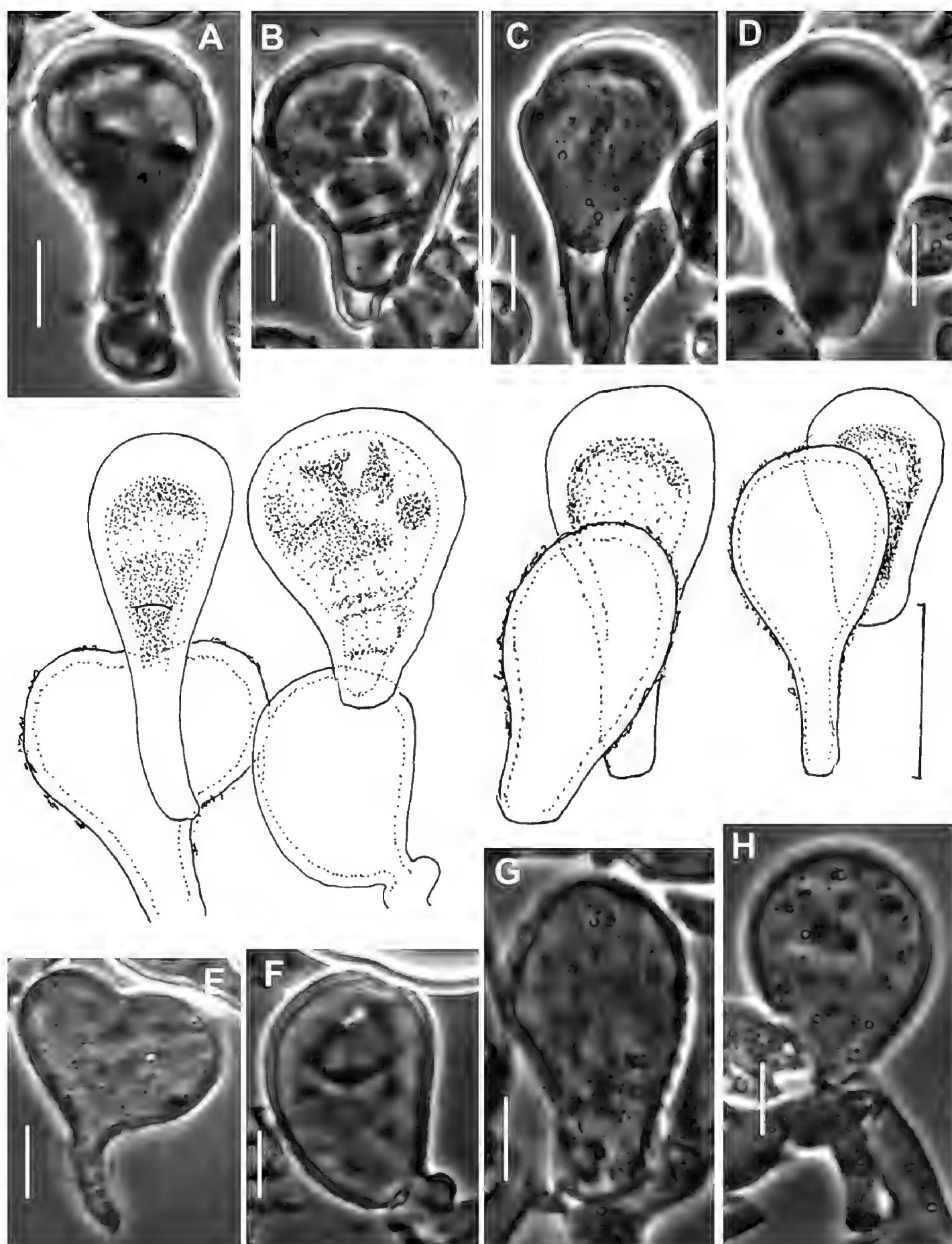
tawny” 6C6, downward to base “mummy brown” 6F8 to “bister” 5F8. **Odor** strong, of garlic, but perhaps not all populations; **taste** not recorded.

**Habitat and phenology** Fruiting substrate soil with most common over-story trees *Pseudotsuga* and/or *Thuja*, probably mulch or minute woody debris; Fall; at this time known only from four collections from urban sites, King Co., Washington.



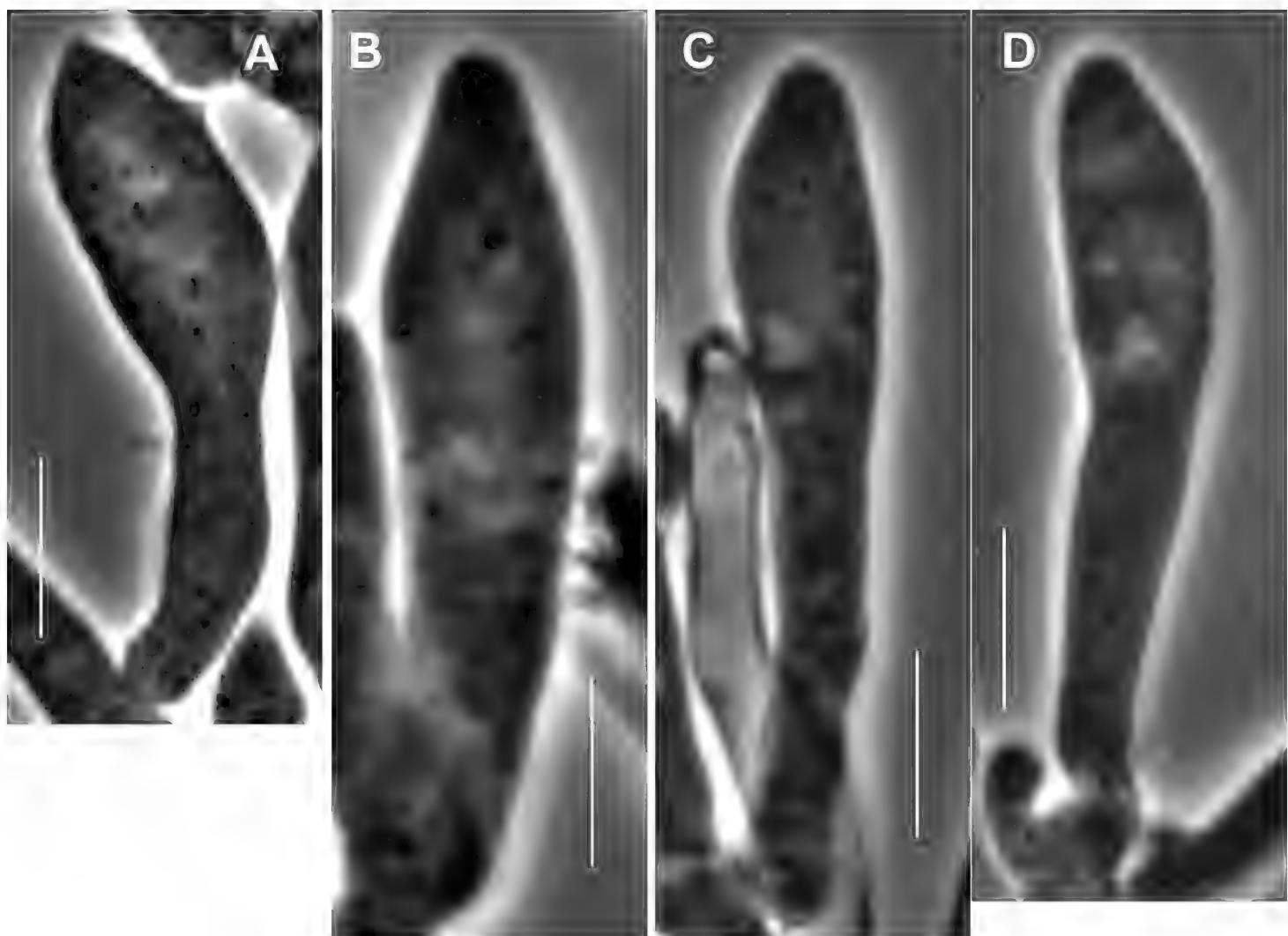
**Figure 79.** *Mycetinis scorodonius* f. *diminutivus*. Pileipellis elements from pileus margin. **A–D** Thick-walled, inflated elements with diverticula **E–H** Arbuscular pileocystidia. Outlines furnished to better interpret photographs. Standard bars = 10 µm. WTU 19061-10-20-2015.

**Pileipellis** complex, differing significantly between pileus margin and pileus disc; pileal hairs not observed. **Pileipellis of pileus margin** a mixture of two elements: 1) inflated elements (Fig. 79A–D)  $12\text{--}27 \times 7\text{--}11$  µm overall, with stalk absent to  $4\text{--}7 \times$



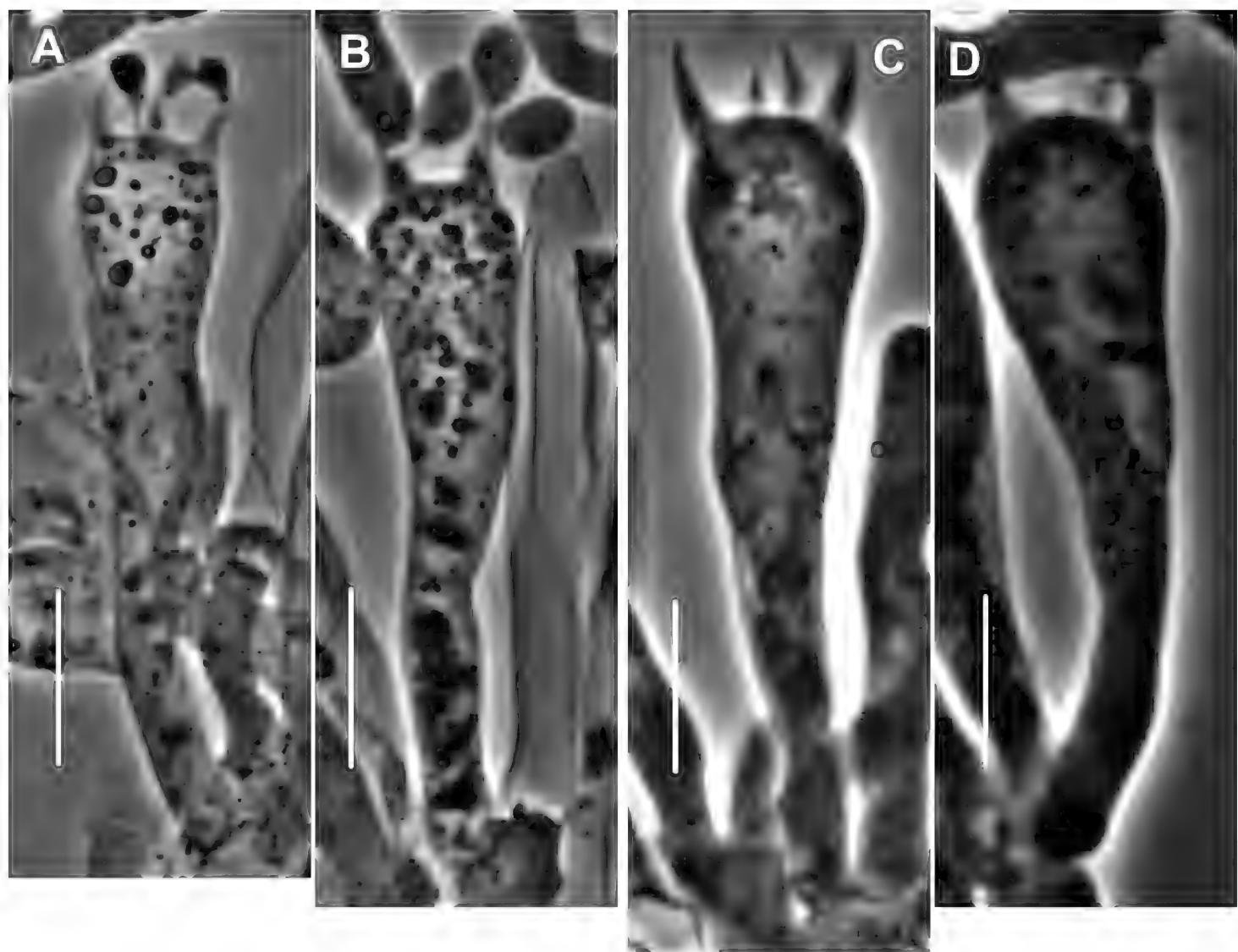
**Figure 80.** *Mycetinis scorodonius* f. *diminutivus*. Pileipellis elements from pileus disc. **A–D** Thick-walled, pigmented elements **E–H** Thick-walled, hyaline elements. Outlines furnished to better interpret photographs. Standard bars = 10 µm. WTU 19061-10-20-2015.

4–5.5 µm, obscurely clamped, thick-walled (wall ~0.8 µm thick, hyaline), delicately roughened, usually producing diverticula apically; diverticula 2–6 × 1–1.5 µm, ranging from bud-like to digitate, usually gnarled and often dichotomous, semi-refract-

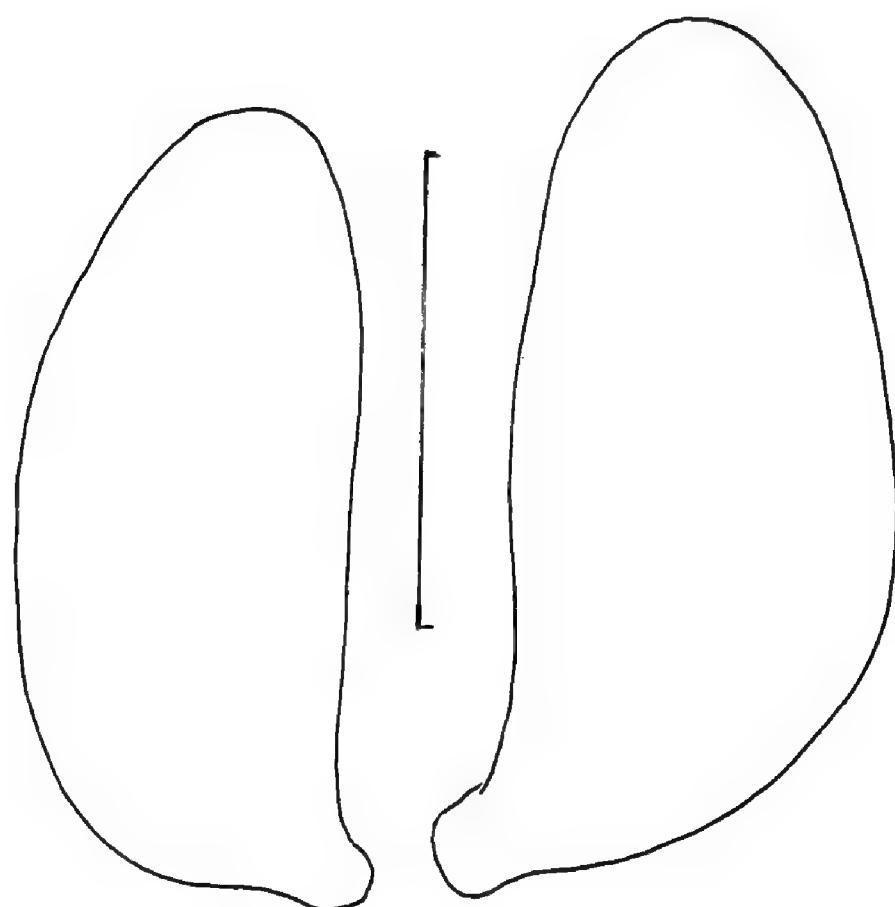


**Figure 81.** *Mycetinis scorodonius* f. *diminutivus*. Pleurocystidia. Standard bars = 10  $\mu\text{m}$ . W TU 10961-10-20-2015.

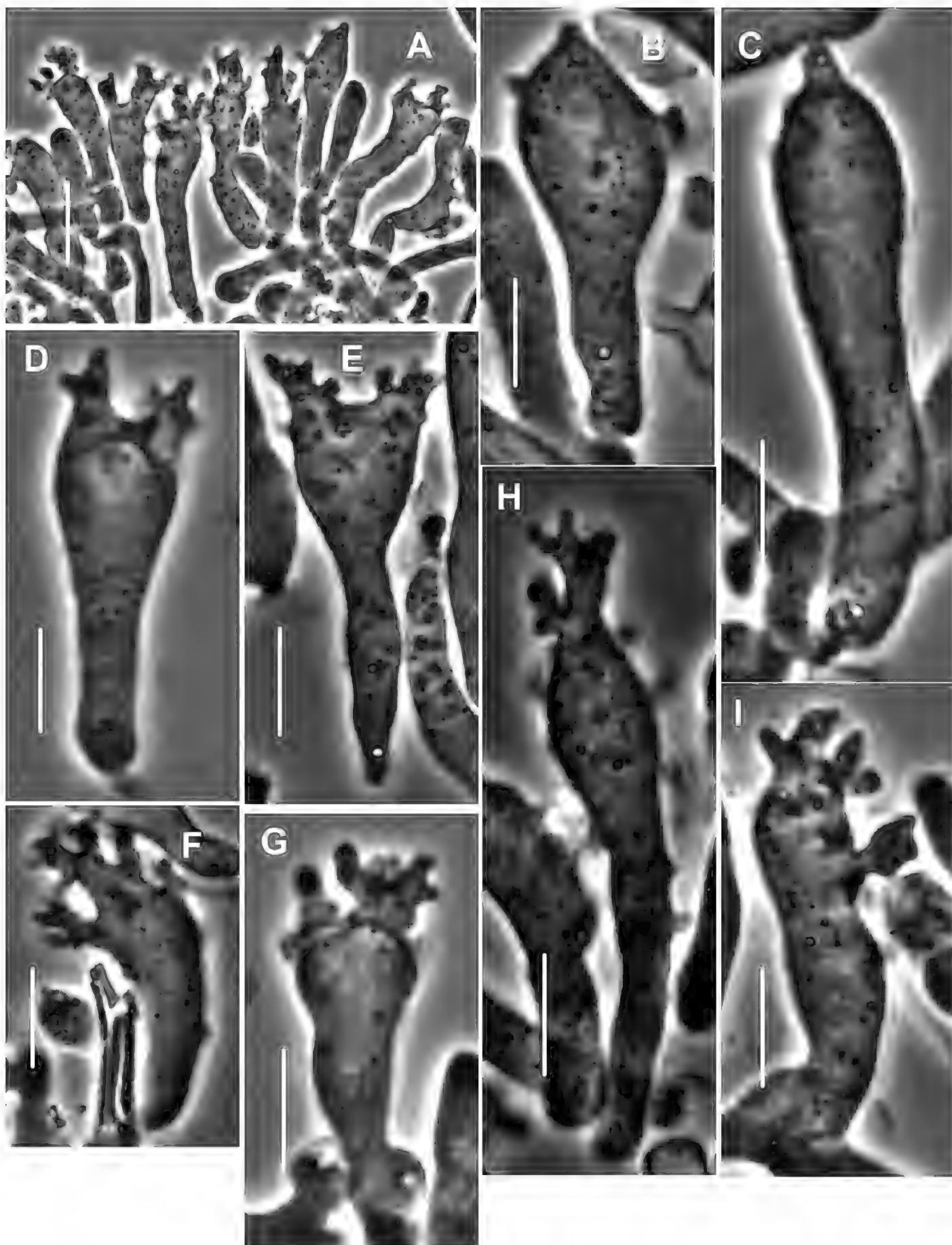
gent; and 2) pileocystidia (Fig. 79E–H) 23–37  $\times$  10–14  $\mu\text{m}$  overall, arbuscular, stalked (stalk 7–18  $\times$  3–5.5  $\mu\text{m}$ , obscurely clamped), producing a complex of diverticula; diverticula 2–8  $\times$  1.5–2.5  $\mu\text{m}$ , gnarled, often dichotomous, refringent. **Pileipellis of pileus** disc a mixture of two elements: 1) inflated hyphal termini (Fig. 79E–H), subglobose, often coarsely dichotomously lobed, thick-walled, smooth or delicately roughened, hyaline, obscurely clamped; and 2) inflated hyphal termini (Fig. 80A–D), significantly thick-walled (wall ~2.0  $\mu\text{m}$  thick along flanks, up to 3  $\mu\text{m}$  thick distally, pigmented yellowish (PhC), smooth; contents dense, pigmented dull ochraceous. Pileus trama loosely interwoven; hyphae 3–7.5(–14)  $\mu\text{m}$  diam, firm-walled, often swollen somewhat near branch points, conspicuously clamped. **Pleurocystidia** (Fig. 81) 29–42  $\times$  7–9  $\mu\text{m}$ , fusiform with acutely rounded apex, conspicuously clamped; contents more or less homogeneous. Basidioles clavate; **basidia** (Fig. 82) 35–40  $\times$  8–10  $\mu\text{m}$ , elongate-clavate, 4-sterigmate, conspicuously clamped; contents heterogeneous, appearing oily. **Basidiospores** (Fig. 83) (7.5-)8–9.5(-10)  $\times$  3.5–4.5(-5)  $\mu\text{m}$  ( $Q = 1.89–2.29$ ;  $Q^m = 2.12$ ;  $L^m = 8.65 \mu\text{m}$ ), ellipsoid to narrowly subamygdaliform, hyaline, thin-walled, inamyloid; contents heterogeneous, multigranular or multiguttulate. Lamellar edge probably sterile; **cheilocystidia** (Fig. 84) plentiful, 23–35  $\times$  6.5–11  $\mu\text{m}$  overall, stalked (stalk 8–20  $\times$  3.5–4.5  $\mu\text{m}$ , obscurely clamped), swollen distally, thick-walled (wall ~0.7  $\mu\text{m}$  thick, hyaline), surmounted by a cluster



**Figure 82.** *Mycetinis scorodonius* f. *diminutivus*. Basidia. Standard bars = 10  $\mu\text{m}$ . W TU 19061-10-20-2015.



**Figure 83.** *Mycetinis scorodonius* f. *diminutivus*. Basidiospores. Standard bar = 5  $\mu\text{m}$ . W TU 19061-10-20-2015.



**Figure 84.** *Mycetinis scorodonius* f. *diminutivus*. Cheilocystidia. **A** Lamellar edge **B, C** Individuals with rudimentary diverticula **D–I** Individuals with typical diverticula. Standard bars = 10  $\mu\text{m}$ . WTU 10961-10-20-2015.

of diverticula; diverticula stiff, rigid, gnarled, often branching, usually dichotomously. **Stipe medullary hyphae** 3.5–8.5  $\mu\text{m}$  diam, firm- to thick-walled (wall ~0.5  $\mu\text{m}$  thick, hyaline), strictly parallel, free (not involved in slime matrix), conspicuously clamped.

**Stipe cortical hyphae** 2–5.5 µm diam, thick-walled (wall ~1.0 µm thick, weakly pigmented), obscurely clamped. **Caulocystidia** absent.

**Commentary.** Pileipellis in *My. scorodonius* f. *diminutivus* is complex. Elements of pileus margin differ substantially from those of the pilus disc. This complexity is similar to that seen in *My. opacus* and *My. scorodonius*, both of which form pileocystidia at or near the pileus margin, and suppress them over the pileus disc. The occasional occurrence of very thick-walled, pigmented inflated individuals in the pileus disc is typical of the genus.

A non-vestured stipe is not typical of *Mycetinis* taxa. *Mycetinis cinnamomeus* from South Australia exhibits basidiomata of similar size; Cleland's description does not include vesture and Desjardin's notes on the type specimen indicates absence of caulocystidia. *Mycetinis scorodonius* also exhibits a glabrous-shining stipe, which may be reflected in ITS sequences from f. *diminutivus*, also without stipe vesture, which match those of *My. scorodonius*. Basidiomatal dimensions are significantly different, however, raising the question of molecular versus morphological evidence. This situation also arises with *My. salalis*/*My. copelandii* (q.v.).

All listed collections of f. *diminutivus* were made in mulched planters near office buildings, from which plant debris was regularly removed. Paucity of substrate, perhaps exacerbated by urban environment (i.e. lack of water, aerial pollution, frequent harsh sunlight, mulch pH, etc.) may be causative factors in the production of diminutive basidiomata.

**Specimens examined.** United States, Washington, King Co., Bellevue, N47°34'55.91", W122°10'06.96", 4.XI.2015, coll. K. Dyson, KLD 2220-11-4-2015 (TENN69345 (holotype); same data, KLD 22218-11-4-2015 (TENN69348); same location, 14.X.2015, coll. K.L. Dyson, KLD 22167-10-14-2015 (TENN69347); Redmond, N47°37'56.04", W122°07'59.56", 20.X.2015, coll. K.L. Dyson, KLD 19061-10-20-2015 (TENN69346).

## 12. *Mycetinis subalpinus* (P.-A. Moreau) R.H. Petersen, comb. nov.

Index Fungorum no. 553207

**Basionym:** *Marasmius subalpinus* P.-A. Moreau 2007. Bull. Mycol. Bot. Dauphiné-Savoie 186: 50.

**Holotype.** Austria, Tirol, Obergurgl, N46°52'13", E11°01'37", 28.VIII.2006, coll. P.-A. Moreau, no. 05082708 (LIP, isotype ZT).

**Diagnosis.** 1) Basidiomata diminutive (pileus 3–10 mm broad; stipe 20–30 × 0.5–1 mm); 2) associated with *Rhododendron ferrugineum* twigs and leaf litter; 3) strong odor of garlic from fresh material but dissipating in drying; 4) adult pileus pallid rosy, shallowly sulcate-striate; 5) spores 9.5–11.8 × 5–6.2 µm, subamygdaliform, somewhat tapered proximally; 6) stipe subinsititious or minutely wooly at base.

The following description is a translation and rearrangement of the protolog description by Moreau (2007).

**Description.** **Basidiomata** diminutive. **Pileus** 3–10 mm broad, strongly convex when young becoming convex, often subtly broadly umbonate, eventually plane to everted, weakly subhygrophanous, smooth, a little glistening, entirely dark reddish in very juvenile specimens, becoming brown-red, rapidly paling to dull ochraceous yellow with age, with central umbo remaining dark reddish, uniformly brownish when dried; margin entire to shallowly sulcate-striate, paler than disc. **Lamellae** distant, thickish, ventricose, adnate, attached to a loose or clasping pseudocollarium, total lamellae 20–28, through lamellae 10–12, whitish then pale cream in age, with scattered dark reddish punctations; lamellulae in 1(-2) ranks. Spores deposit not obtained. **Stipe** 20–30 × 0.5–1 mm, terete, equal, insititious to subinsititious, flocculose at apex and occasionally to midsection, somber reddish when young, in age assuming an ochre shade, yellow-red mycelium apparent on the stipe apex. **Rhizomorphs** not visible. Flesh pliant, reviving. **Odor** very powerful of garlic (*Allium sativum*), dissipating on drying but regenerating on rehydration; **taste** alliaceous, sweet.

**Habitat and phenology.** Known from only few specimens; apparently associated with dead twigs, leaves and litter of *Rhododendron ferrugineum*; approximately tree-line in *Rhododendron* belt in mountains of central Europe (Austria, France, Switzerland); mid-summer.

**Pileipellis** an irregular hymeniform layer about 80 µm thick, of hyphal termini 18–55 × 6–22 µm, arising from subterminal elements, irregularly clavate to obpyriform, thin- to thick-walled (wall ~1 µm thick, yellow brown), entire to mostly forming digitate diverticula, mixed with shorter, non-emergent, cylindrical articles; diverticula 3–6 µm long. Hypodermium filamentous, hardly differentiated, of slender hyphae (2–4 µm diam), smooth or with pigment incrustation in hardly separable scabs. Pileus trama dextrinoid, of mixed hyphae, more regular in hypolamella, with slender cylindrical hyphae (~3.5–10 µm diam), smooth or with various granular pigment deposits here and there. Lamellar trama regular, dextrinoid, of slender, clamped hyphae (3–3.5 µm diam), parallel, hyaline. Subhymenium filamentous, dense, arranged in a layer. **Pleurocystidia** fusiform, with attenuate apex before maturity, clamped (see illustration with basidia; Moreau 2007). Basidioles clavate, clamped; **basidia** 38–45 × 8.5–9.5 µm, cylindro-clavate, (2-)4-sterigmate, clamped; sterigmata short. **Basidiospores** (9.0)9.5–11.8(12) × 5.0–6.2 µm [ $Q = (1.60)1.75–2.03(2.20)$ ], fusiform-amygdaliform to subcylindrical, generally more or less obtuse distally, smooth, non-dextrinoid, not cyanophilous; contents often with a large central guttule. Lamellar edge sterile; **cheilocystidia** 22–40 × 6–10 µm, numerous but short and hardly emergent, cylindrical, lobed with irregularly digitate diverticula, mixed with clavate basidioles with yellowish content. **Stipe cortex** of slender hyphae (3–5 µm diam), with fine, yellow, strongly localized incrustations; medulla dextrinoid; **caulocystidia**, 18–80 × 4–11 µm, hyaline, gnarled, cylindrical or clavate, isolated or in compact bouquets.

**Commentary.** Moreau (2007) compared *M. subalpinus* to *M. kallioneus* and *M. scorodonius* var. *virgultorum* (here at species rank), now accepted as members of *Myctenitis*, and suggested (pers. comm.) such a transfer for *M. subalpinus*. The coarsely hymeniform pileipellis of *M. subalpinus*, composed of inflated, thick-walled hyphal

termini and broom cell-like, branched pileocystidia, is also typical of *Mycetinis*. Macroscopically, basidiome size and stature, with reddish coloration, thick, ventricose lamellae attached to a clasping pseudocollarium also point toward *Mycetinis*. Association with *Rhododendron* is similar to substrate preference of *M. opacus*, which also exhibits branched pileocystidia, but similarities end with these limited characters. Basidiomatal size and stature are reminiscent of *My. curraniae*, *My. olidus* and *My. cinnamomeus*.

### **13. *Mycetinis virgultorum* (Malençon & Bertault) R.H. Petersen, stat. nov.**

Index Fungorum no. 553208

**Basionym:** *Marasmius scorodonius* var. *virgultorum* Malençon & Bertault. 1975. Flores des champignons superieurs du Maroc II: 378(-382).

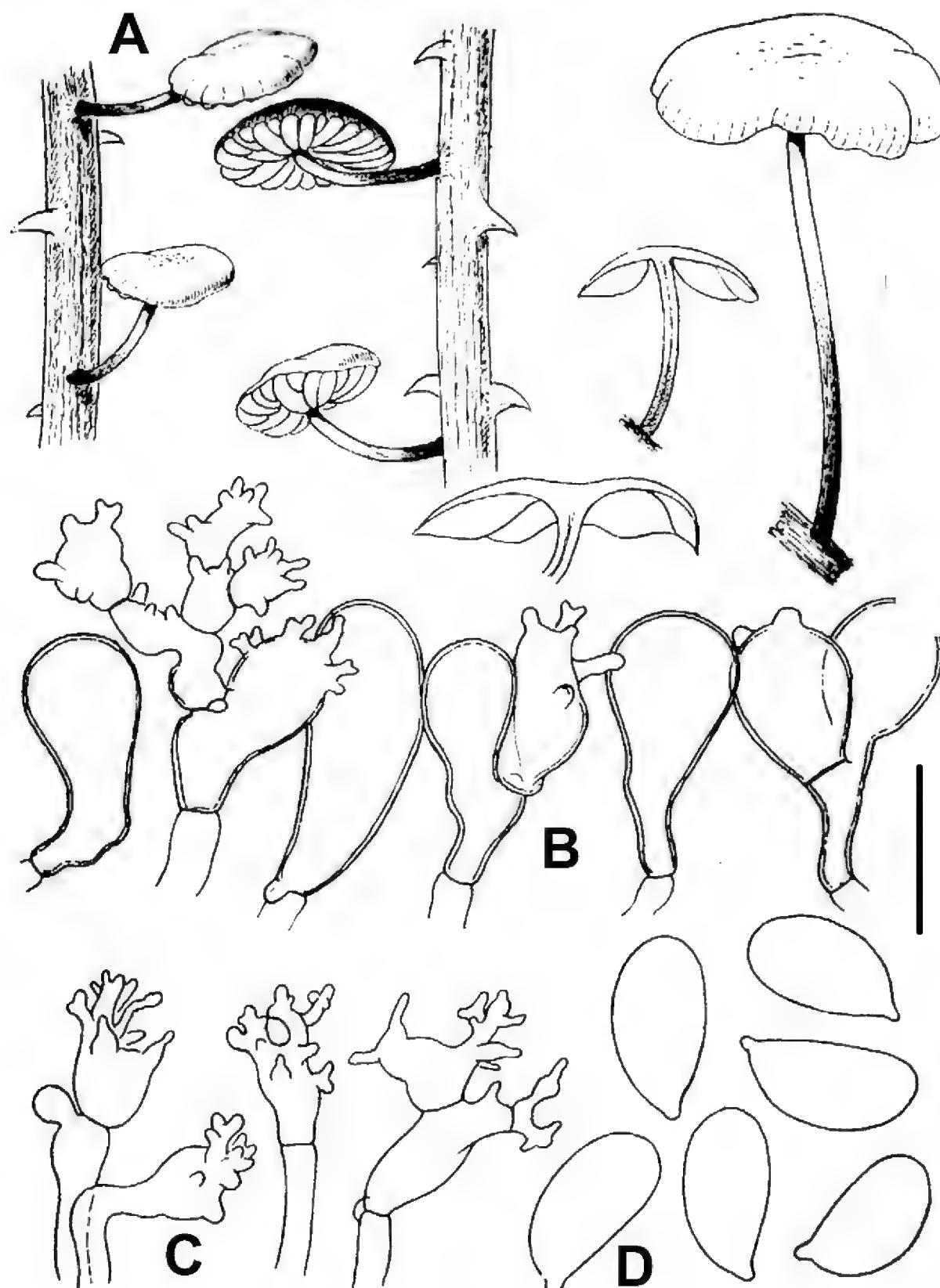
≡ *Mycetinis scorodonius* var. *virgultorum* (Malençon & Bertault) Antonín & Noordel. 2008. Czech Mycol. 60: 26.

**Holotype.** Morocco, herb. Malençon, no. 5663, Institute Montpellier (MPU) [material unavailable].

**Diagnosis.** 1) Basidiomata diminutive (pileus 3.5–8 mm broad; stipe 7–18 × 0.4–0.5 mm), marasmielloid; 2) distribution trans-Mediterranean; 3) fruiting on canes of *Rubus* and other deciduous detritus; 4) stipe vested overall or at least upward; 5) stipe pale upward, downward brown-red; 6) spores 7–8 × 3.6–4.3 µm.

The following description is a combination and rearrangement of descriptions by Malençon and Bertault (1975), Eyssartier and Moreau (2001), and Antonín and Noordeloos (2010).

**Description.** **Basidiomata** (Fig. 85A) diminutive, marasmielloid. **Pileus** 3.5–8 mm broad, hemispherical when young and then subumbonate, becoming convex then applanate, in age usually applanate to everted, not hygrophanous, drying uniformly, thin and supple, dry, sometimes subrugulose, obscurely bruised over disc, pruinose and finely powdery or minutely saccharine-granular; disc reddish alutaceous, between ferruginous and fulvous (Saccardo, Chromotaxia), dark reddish (Eyssartier and Moreau 2001); margin involute when young, then downturned, entire, sometimes visibly striate in age, paler than disc to off-white, perhaps with weak pinkish tint (“beige-carné” teste Eyssartier and Moreau 2001). **Lamellae** adnexed to nearly free (broadly adnate to emarginated (teste Antonín 1995), -1.5 mm broad, moderately close to distant, total lamellae 12–15 (19–22 teste Antonín (1995); 20–24 teste Eyssartier and Moreau 2001), through lamellae 4–6 (two teste Antonín 1995), acute toward pileus margin, enlarged and sinuate near attachment, white to cream-colored on face, rosy cream on sinus, in rugulose ridges, finally interveined or reticulate in age; lamellar edge concolorous, pubescent (teste Antonín 1995); lamellulae in one rank (teste Eyssartier and Moreau 2001). Spores white. **Stipe** (4-)7–18(-25) × 0.3–0.5(-1) mm, slender, terete, equal through its major part although dilated under the lamellae and sometimes subbulbous at base, erect or ascendant, rigid, insititious (teste Antonín 1995) hollow when adult, a



**Figure 85.** *Mycetinis virgultorum*. **A** Basidiomata **B** Pileipellis structures **C** Cheilocystidia **D** Basidiospores. Standard bars: **B–D** = 10 µm; **A** = not to scale; smaller basidiomata circ. 2x, basidiome at right circ. 5x. Adopted from Malençon & Bertault, 1975.

little pruinose at apex, downward smooth or hairy (entirely furfuraceous-squamulose, strigose at base, teste Antonin 1995) (“avec seulement quelque courts trichoides bruns à la base” teste Eyssartier and Moreau 2001), cream colored at apex, amber and darker to brown-red downward (“rouge-purpurin sombre” teste Eyssartier and Moreau 2001). Flesh thin, white or weakly tinted under the union to stipe or apex of stipe, rosy at its base. **Odor** of garlic, perceived in nature even before the basidiomata; **taste** similar (teste Antonín 1995).

**Habitat and phenology.** Fruiting on canes of *Rubus discolor*, decaying deciduous leaves and twigs, including *Quercus coccifera*, *Viburnum*, *Erica*; distribution (see Antonín 1995; Antonín and Noordeloos 2010; Eyssartier and Moreau 2001) trans-Mediterranean Sea, as far north as France (Bon 1994); March, June, October, November, December.

**Pileipellis** (Fig. 85B) composed of a coarse hymeniform layer of hyphal termini of two types: 1) about  $20\text{--}30(-40) \times (7\text{--})10\text{--}15(-40)$   $\mu\text{m}$ , clavate, broadly clavate to obpyriform, firm- to thick-walled (wall  $<1$   $\mu\text{m}$  thick), sometimes pigmented brownish (teste Antonin 1995); and 2) firm-walled, deformed or arbuscularly branched with irregular digitate protuberances. Pileus flesh interwoven, lacunose, composed of filamentous hyphae  $3.5\text{--}8$   $\mu\text{m}$  diam, branched, clamped, secondarily septate, often encrusted with plaques and/or zebroid deposits. **Pleurocystidia** probably present, fusiform (see illustration of basidioles by Eyssartier and Moreau 2001). Basidioles cylindrical to narrowly clavate; **basidia**  $23\text{--}31 \times 5\text{--}7$   $\mu\text{m}$ , cylindro-clavate, 4-sterigmate, clamped at base; sterigmata more than  $3$   $\mu\text{m}$  long. **Basidiospores** (Fig. 85D)  $7\text{--}8 \times 3.6\text{--}4.3$   $\mu\text{m}$ , ellipsoid to subnavicular to a base with small, oblique apiculus, hyaline, thin-walled, inamyloid. Lamellar edge sterile; **cheilocystidia** (Fig. 85C)  $15\text{--}30 \times 6.2\text{--}9.2$   $\mu\text{m}$  (teste Antonin 1995), hyaline, clavate to subglobose, surmounted by coarse, mostly digitate or coralloid diverticula. **Stipe medullary hyphae**  $10\text{--}13$   $\mu\text{m}$  diam, strictly parallel, firm- to thick-walled (wall  $-2.5$   $\mu\text{m}$  thick), resembling large fibers, which cover the bottom of the stipe. **Stipe cortical hyphae**  $3\text{--}4(-6.5)$   $\mu\text{m}$  diam, thick-walled (wall  $-1.5$   $\mu\text{m}$  thick, pigmented). **Caulocystidia** (teste Antonin 1995) in scattered bundles of (sub)erect, cylindrical hyphae present on stipe surface.

**Commentary.** The description above is adopted from those cited herein. Although the abbreviated translation of Malençon's and Bertault (1975) description presents an outline of characters, descriptions of other characters are missing: 1) stipe seems to be smooth, without caulocystidia, although caulocystidia are reported by others; 2) stipe insertion is illustrated as insititious but not described as such; 3) pleurocystidia are reported as absent, but "basidioles" are reported as clavate or fusoid, and the fusoid structures are probably pleurocystidia. Antonin (1995), based on a specimen from Italy, and Eyssartier and Moreau (2001) offered more complete descriptions, but still without recognition of pleurocystidia.

Antonin's (1995) report of spore dimensions:  $(5.8\text{--})6.3\text{--}7.7 \times 3.1\text{--}3.8$   $\mu\text{m}$  [E =  $1.8\text{--}2.0(-2.3)$ , Q = 2.0]. Spore measurements by Eyssartier and Moreau (2001):  $6.5\text{--}7.5 \times 3\text{--}4(4.5)$   $\mu\text{m}$ .

Malençon and Bertault (1975) had opportunity to see *M. scorodonius*, which also produced a strong garlic odor, and concluded that their organism was a dwarf state. Simultaneously, however, their basidiomata resembled more closely those of *M. (Ma.) ramealis*, differing in pileipellis characters.

A parallel situation of basidiomatal size concerns *My. copelandii* var. *olidus*, in which basidiomatal size, fruiting substrate and distribution of the variety all differ from its parent species. *My. olidus* is here proposed at species rank. Likewise, in light of basidiome size throughout *Mycetinis*, which seems to sort into two categories, it is difficult to treat *My. virgultorum* as a variety under *My. scorodonius*, so it is here proposed at species rank.

Desjardin and Horak (1997) mentioned similarities between *M. curraniae* and *M. scorodonius* var. *virgultorum*. The two would seem to exhibit similar morphological characteristics, but fruiting substrate and a circum-Mediterranean distribution would seem exclusive to the Antipodal fungus. Perhaps comparison should be made also with *My. cinnamomeus* from South Australia. When molecular data on *My. virgultorum* become available, this situation may be elucidated.

#### **14. *Mycetinis yunnanensis* R.H. Petersen, sp. nov.**

Index Fungorum no. 553209

**Holotype.** **China**, Yunnan Prov., Simao Pref., vic. Simao, "Red Flag Preserve," N22°47'23", E100°58'33", 4.VIII.1990, coll. RHP, Wu Qiu-xin, Li, TFB 3103a (TENN-F-49172)

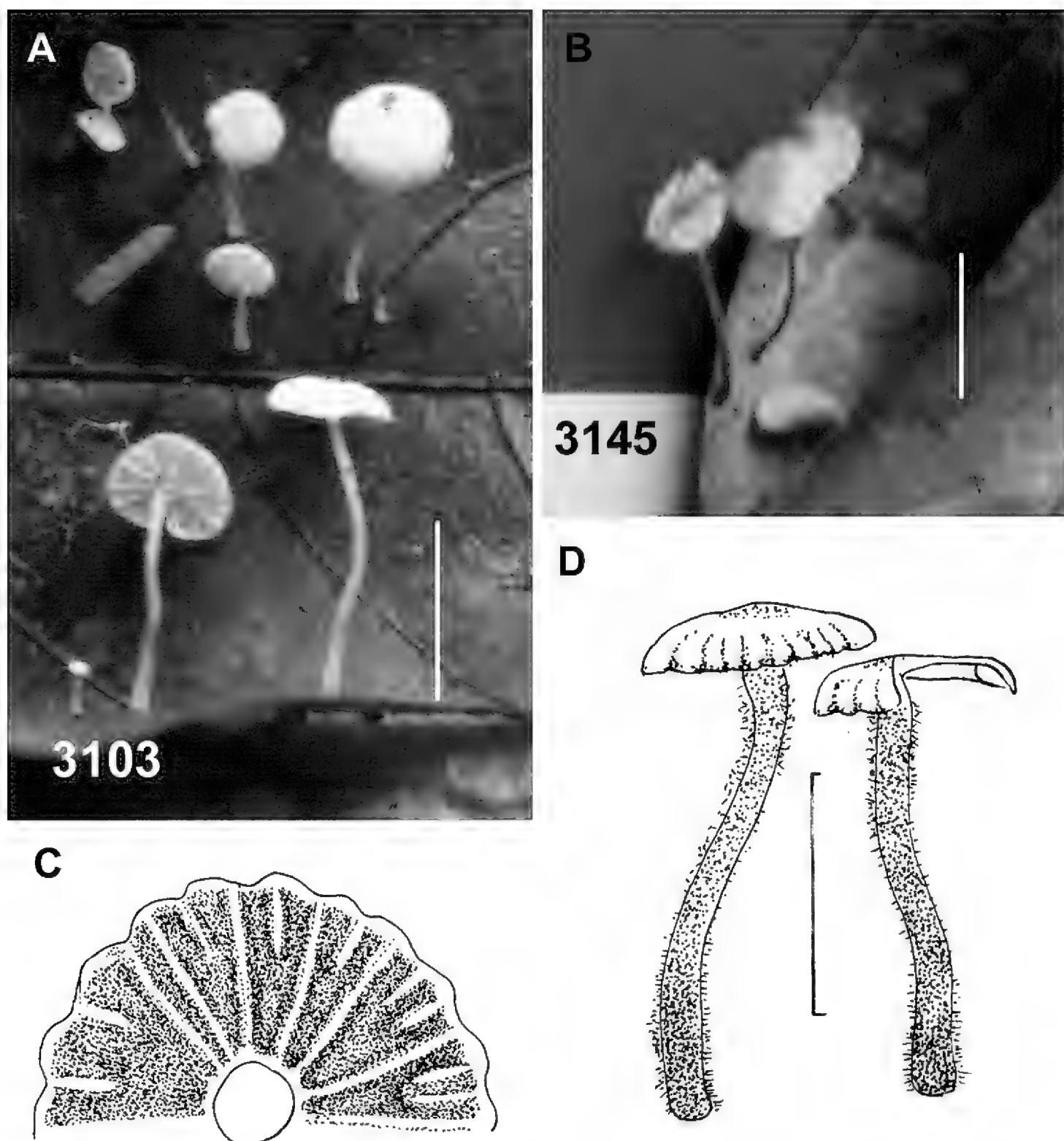
**Etymology.** Yunnanensis; referring to Yunnan Province, China, where all known collections were found.

**Diagnosis.** 1) Diminutive basidiomata (pileus 3–8 mm broad; stipe 10–17 × 0.3–0.8 mm); 2) white to off-white, convex pileus; 3) vested stipe; 4) spores 6–9.5 × 3–4 µm ( $L^m = 7.3 \mu\text{m}$ ); 5) habitat on dead sclerophyllous leaves; 6) distribution in southwestern China.

**Description.** **Basidiomata** (Fig. 86A, B, D) diminutive, loosely gregarious on midribs of subsclerophyllous leaves. **Pileus** 3–8 mm broad, convex to shallowly convex, smooth, dull, not glabrous (perhaps suede-like), white to off-white when fresh, with disc slightly pallid grey, when dried becoming ochraceous orange; margin somewhat scalloped, shallowly sulcate, downturned. **Lamellae** (Fig. 86C) distant, adnexed, seceding on drying, not well-developed (<1 mm broad), thickish, not anastomosing or forked, total lamellae 26–29, through lamellae 8–13, with a few rudimentary lamellulae in one rank, white when fresh, drying to near "ochraceous buff" 5A5; lamellar edge minutely fimbriate, paler than lamellar face. **Stipe** 10–17 × 0.3–0.8 mm, subinsititious, probably terete when fresh, more or less equal, somewhat compressed in drying, cartilaginous, now "pinkish buff" 6A3 upward, somewhat duller downward, vested from throughout to upward and downward but missing from midsection (probably through handling); vesture upward scattered and curly, downward becoming delicately strigose or hairy, near "tilleul buff" 7B2. **Rhizomorphs** not observed. **Odor** and **taste** not recorded.

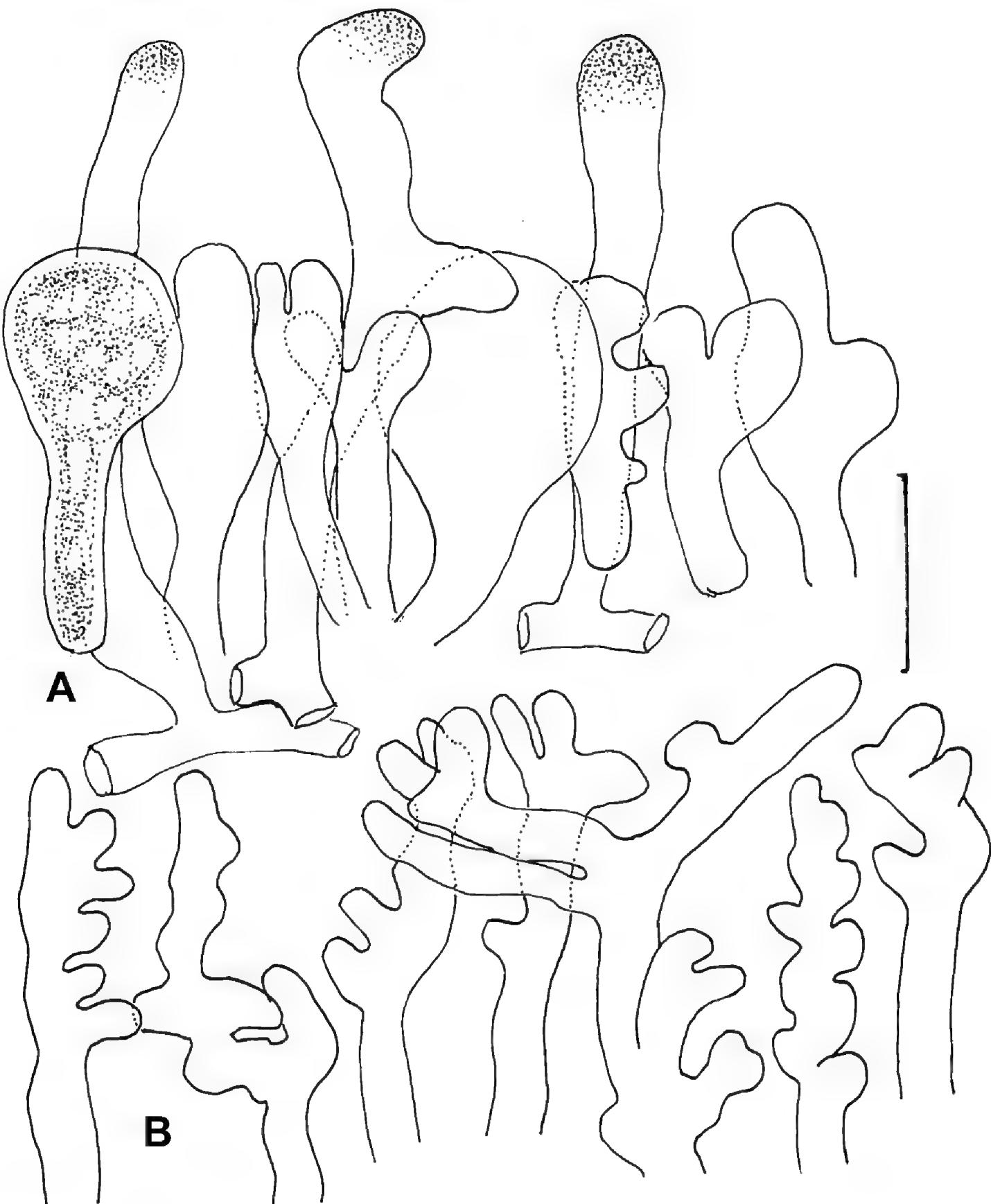
**Habitat and phenology.** Known from three collections, all fruiting on fallen sclerophyllous leaves; so far known only from Yunnan Province, China; mid-summer.

**Pileipellis near pileus margin** (Fig. 87B) a tangle of coarsely diverticulate hyphae; hyphae 3–5 µm diam, thin- to firm-walled, obscurely clamped, often sinuous, with lobe-like diverticula often arising unilaterally; diverticula 3–6 × 2.5–4 µm, rounded, often dichotomous, occasionally capitate. **Pileipellis over disc** (Fig. 87A) composed of the following: 1) pileal hairs common, probably erect, -75 × 4.5–8 µm, thin- to firm-walled, often minutely roughened, usually subcapitulate; 2) a more or less monolayer of inflated hyphal termini ranging from subcapitulate to sphaeropedunculate (-25 µm



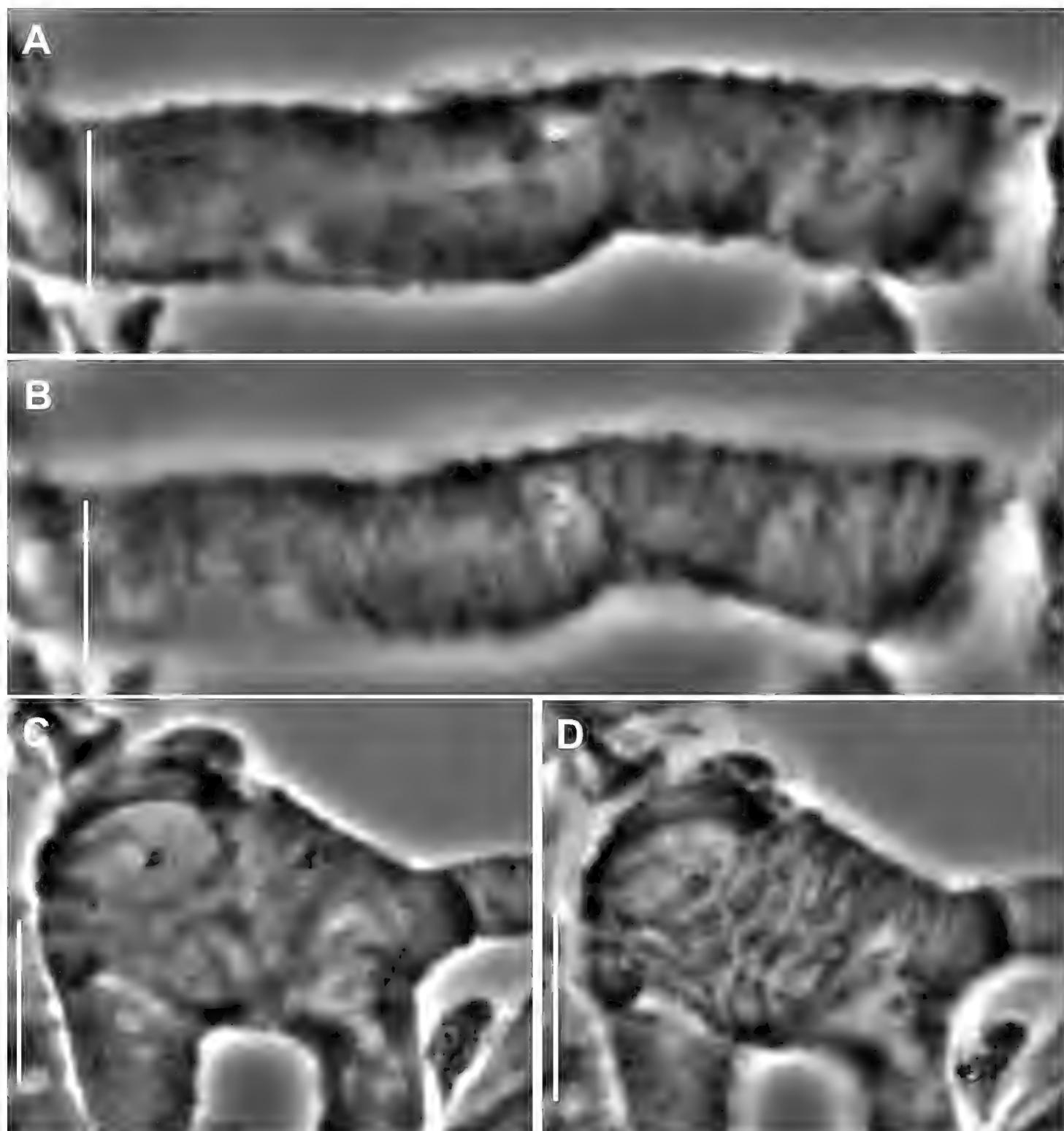
**Figure 86.** *Mycetinis yunnanensis*. Basidiomata. **A** TFB 3103 **B** TFB 3145 **C** Arrangement of lamellae and lamellulae **D** Basidiomata. Standard bars: **A, B, D** = 10 mm. **C** = not to scale.

diam), often lobed to free-form, often stalked (stalk  $14 \times 3\text{--}4.5 \mu\text{m}$ , obscurely clamped), thin- to firm-walled; rare thick-walled (wall  $1.5 \mu\text{m}$  thick) individuals observed, usually strongly pigmented; 3) subpellis largely a repent layer of cylindrical hyphae (Fig. 88)  $3.5\text{--}8 \mu\text{m}$  diam, thin-walled, inconspicuously clamped, often lightly encrusted with suggestion of delicate annular configuration; diverticulate hyphae of pileus margin rare to absent. Pileus and lamellar tramae loosely interwoven, free (not involved in slime matrix); hyphae  $3\text{--}6.5(-8.5) \mu\text{m}$  diam, thin-walled, conspicuously clamped. Hymenium involving some vaguely slimy matrix, obscuring observation and illustration of structure bases and walls. **Pleurocystidia** (Figs 89, 91A) common,  $16\text{--}25 \times 6\text{--}8 \mu\text{m}$ , fusiform



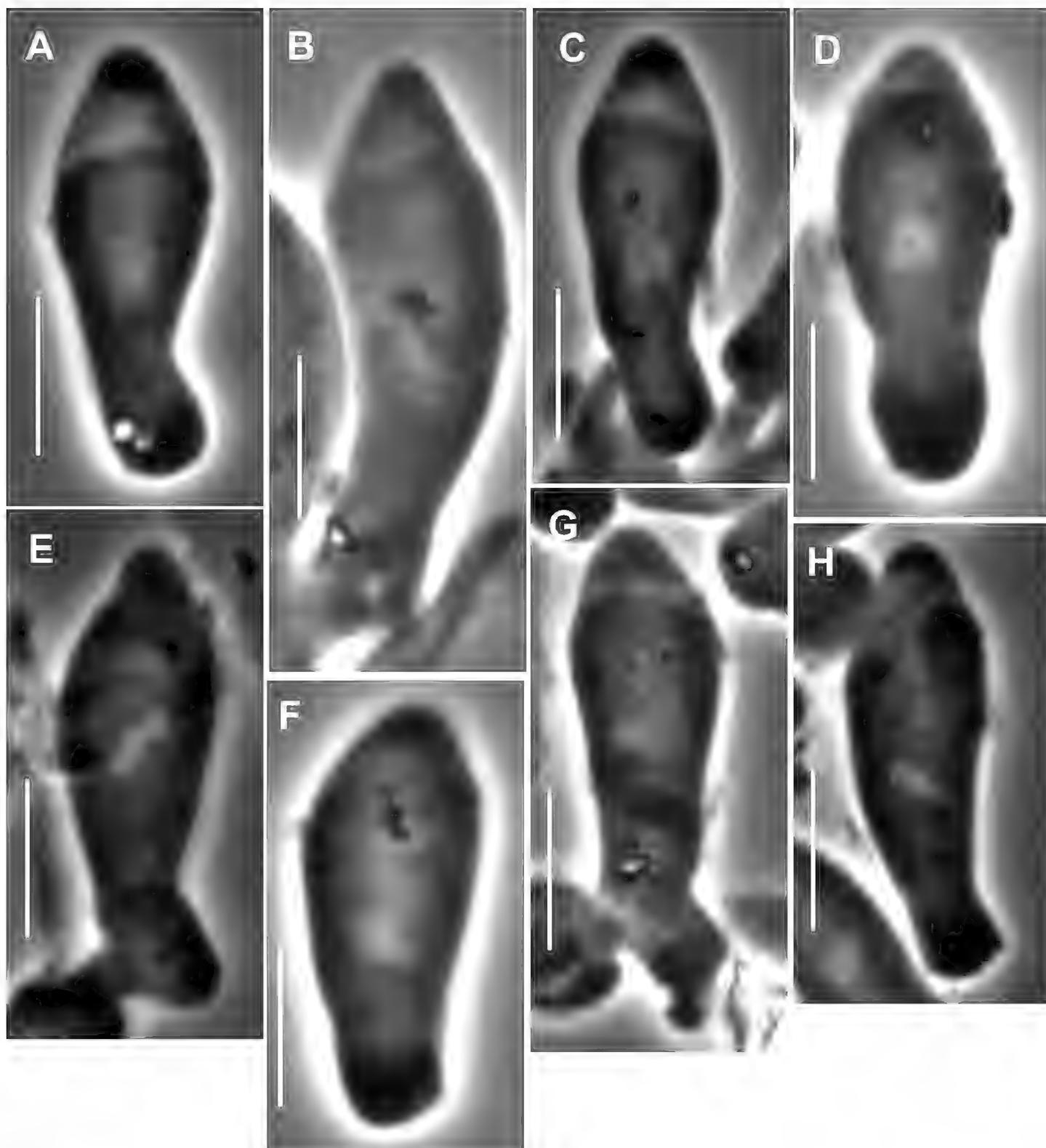
**Figure 87.** *Mycetinis yunnanensis*. Pileipellis structures. **A** Pileipellis structures of pileus disc **B** Diverticulate hyphae of pilus margin. Standard bars = 10  $\mu\text{m}$ . TFB 3103 (TENBN-F-49172).

to swollen-fusiform, rounded at apex, inconspicuously clamped, thin- to firm-walled; contents more or less homogeneous, often vaguely partitioned. Basidioles subampulliform, becoming clavate; **basidia** (Fig. 91B) 20–23 × 9–11  $\mu\text{m}$ , clavate, 4-sterigmate, obscurely clamped; sterigmata slender, curved. **Basidiospores** (Fig. 91E) 6–7.5(-8.5) × 3–4(-4.5) $\mu\text{m}$  ( $Q = 1.67–2.33$ ;  $Q^m = 1.95$ ;  $L^m = 6.9 \mu\text{m}$ ), ellipsoid, subamygdaliform, gymnopoid (not tapering proximally), flattened adaxially, often somewhat humped



**Figure 88.** *Mycetinis yunnanensis*. Pileipellis hyphae. **A, C** Hyphae seen in profile; note ornamentation appears vague, perhaps spotty **B, D** Hyphae seen in upper wall surface; note suggestion of annular or striped configuration. Standard bars = 10  $\mu\text{m}$ . TFB 3146 (TENN-F-49385).

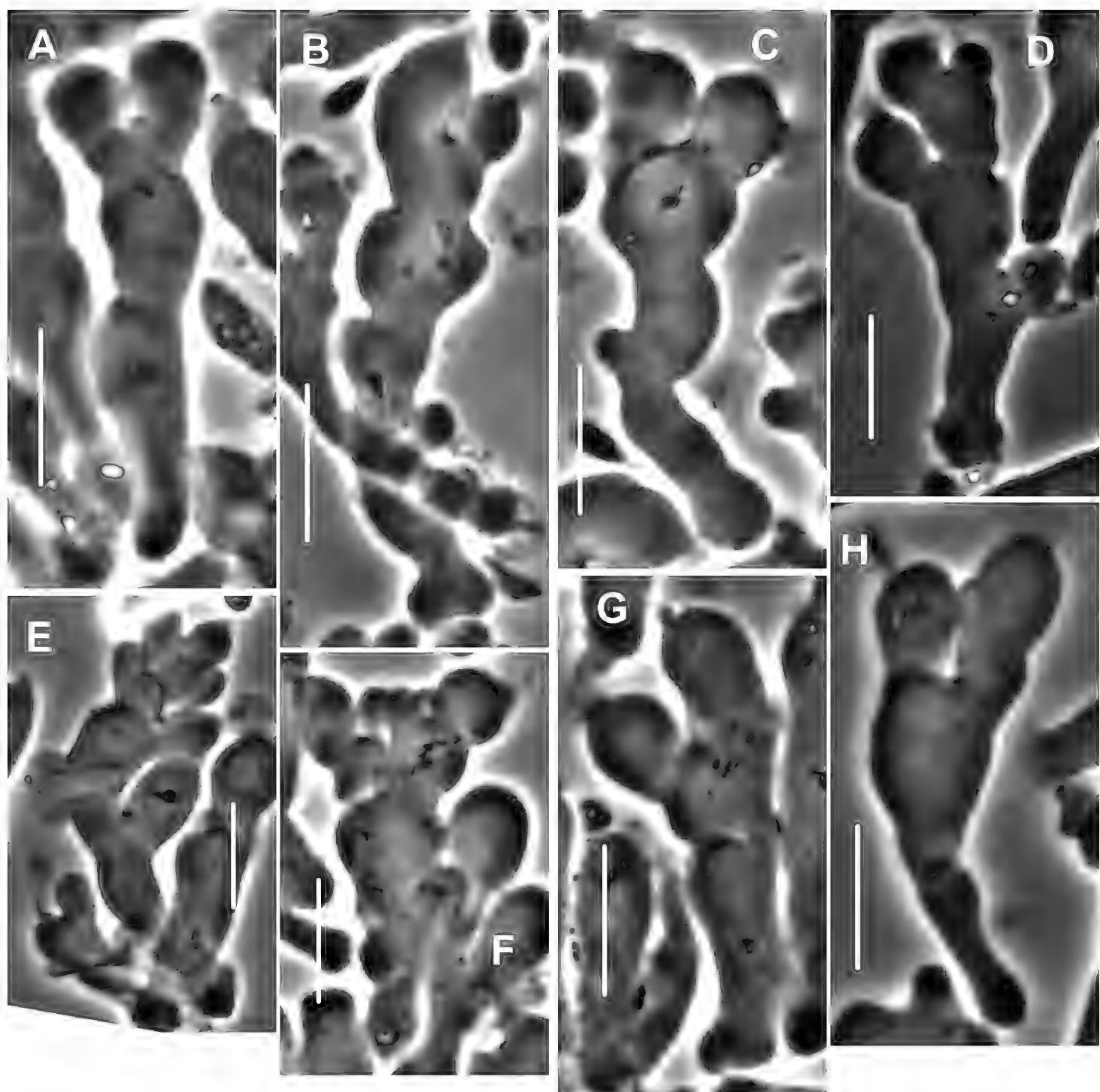
abaxially, thin-walled, inamyloid. **Cheilocystidia** (Figs 90, 91C) (15-) 18–36(-45)  $\times$  9–20  $\mu\text{m}$ , stalked [stalk 5–16(-25)  $\times$  3–4(-6)  $\mu\text{m}$ , clamped, thin-walled], lumpy or subarbuscular, coarsely diverticulate; diverticula coarse, 3–8  $\times$  2–3.5(-7)  $\mu\text{m}$ , knobby to inflated into strangulate dichotomous lobes or clusters of broadly ellipsoid to sub-globose cells often capitate, thin-walled, often terminating in pseudosterigma or beak. **Stipe medullary hyphae** 5–7.5  $\mu\text{m}$  diam, firm- to thick-walled (wall 1  $\mu\text{m}$  thick, hyaline), conspicuously clamped, free (not involved in slime matrix), parallel. Stipe cortical hyphae similar, producing caulocystidia as side branches or termini. **Caulocystidia** (Fig. 91D) thickly gregarious but not coherent, 120  $\times$  5–7  $\mu\text{m}$ , serpentine, occasionally



**Figure 89.** *Mycetinis yunnanensis*. Pleurocystidia. Note vague content partitioning in **A–D, G,H**. Note clamp connections in **B, E, G**. Standard bars = 10  $\mu\text{m}$ . TFB 3146 (TENN-F- 49385).

internally septate, commonly branched (branches often lobe-like), thick-walled (wall ~1.5  $\mu\text{m}$  thick, hyaline), usually narrowed at origin, appearing delicately wooly (at 40 $\times$ ).

**Commentary.** Macroscopically, basidiomata of *M. yunnanensis* closely resemble those of *My. olidus* from eastern North America. Experience indicates that these distributions are allopatric, and *My. yunnanensis* differs from *My. olidus* in habitat (sclerophyll leaves for *My. yunnanensis*, less sclerotic deciduous leaves for *My. olidus*), cheilocystidia (cheilocystidia of *My. olidus* expanded, utriform or utriform-lobed), caulocystidia (setoid, straight in *My. olidus*) and spores (11–16  $\times$  3.5–4  $\mu\text{m}$ ;  $L^m$  = 13.7  $\mu\text{m}$  for *My. olidus*). Similarity is merely superficial based on basidiomatal size and stature.



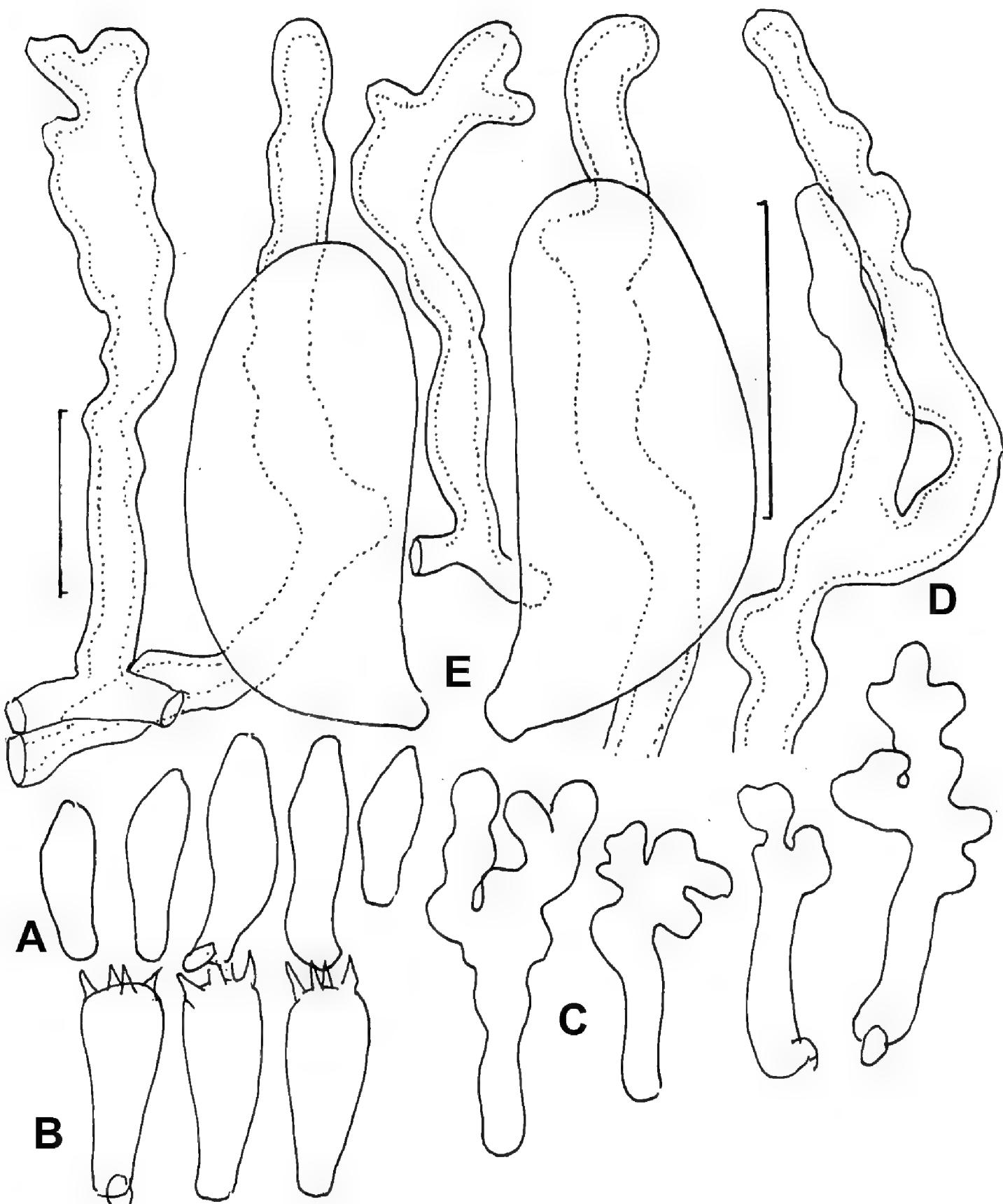
**Figure 90.** *Mycetinis yunnanensis*. Cheilocystidia. **A-C, G, H** Dichotomously lobate individuals **D-F** Multilobate individuals. Note beaked or pseudosterigmate apices in **B, D, F-H**. Standard bars = 10  $\mu\text{m}$ . TFB 3145 (TENN-F- 49384).

The transition of pileipellis from a tangle of diverticulate hyphae at pileus margin to a coarse hymeniform layer of expanded hyphal termini is gradual but dramatic. It parallels the same phenomenon in *My. opacus*, but otherwise, the two are quite different.

Basidiospores are easily collapsed, quite like those of *My. olidus*, but somewhat shorter. As several other *Mycetinis* taxa, large numbers of basidiospores remain lodged on or in the hymenium and are present when microscope mounts are made. Care must be taken, however, for most spores are semi-collapsed and not fit for spore statistics.

Unfortunately, taste and odor of fresh specimens were not recorded. An odor of garlic might be expected, based on its commonality in *Mycetinis* and particularly in *M. olidus*.

**Specimens examined.** China, Yunnan Prov., Simao Pref., vic. Simao, "Red Flag Preserve," N22°47'23", E100°58'33", 4.VIII.1990, coll. RHP, Wu Qiu-xin, Li, TFB



**Figure 91.** *Mycetinis yunnanensis*. Microstructures. **A** Pleurocystidia **B** Basidia **C** Cheilocystidia **D** Caulocystidia **E** Basidiospores. Standard bars: **A–D** = 10 µm. **E** = 5 µm. TFB 3103 (TENN-F-49172).

3103a (TENN-F-49172; holotype); Yunnan Prov., Jinhong Pref., Xishuangbanna, vic. Menghai, N $21^{\circ}58'15''$ , E $100^{\circ}27'09''$ , nature preserve, 8.VIII.1990, coll. RHP, Wu Qiu-Xin, Li, TFB 3146 (TENN-F-49385); Yunnan Prov., Jinhong Pref., Xishuangbanna, vic. Menghai, N $21^{\circ}58'15''$ , E $100^{\circ}27'09''$ , nature preserve, 8.VIII.1990, coll. RHP, Wu Qiu-Xin, Li, TFB 3145 (TENN-F-49384).

### Doubtful species

***Cantharellus alliodorus* Mont. 1835., Prodromus Juan Fernandez: Ann. Sci. Nat., ser. 2, 3: 349**

- ≡ *Marasmius alliodorus* (Bertero ex Mont.) Fries 1838 Epicrisis 384.
- ≡ *Marasmiellus alliodorus* (Bertero ex Montagne) Singer 1955. Sydowia 9: 381 [see Index of Fungi 2: 277 as "alllodorus" not validly published].
- ≡ *Marasmiellus alliodorus* (Mont.) Singer, Ark. Bot. ser. 2, 4(9): 381. 1959.

**Commentary.** In spite of an extensive literature (Singer 1955, 1959, 1965, 1969, 1973, 1975), two questionable illustrations (Singer 1973, fig. 96; Singer 1959 Pl. 1, fig. 1) and Singer's report on the type specimen (Singer 1955), the affiliation of this organism remains in doubt. Some literature is arcane and/or imprecise and authentic herbarium material unavailable. Two detailed but almost identical descriptions (including but not limited to authentic and type specimens; Singer 1955, 1959) can be dissected, but Singer (1959, 1965) indicated a wide variation in macromorphological appearance (referring to four "forms," although without formally proposing them).

Two characters give cause to consider the fungus as belonging in *Mycetinis*: 1) [Singer 1969: "The carpophores as well as the mycelium have a strong smell of garlic (which, in our region, they have in common only with *Marasmius aporpocephyses*), so that it is often smelled before it is seen"]; and 2) structure of pileipellis, described and illustrated as composed of swollen hyphal termini, often with diverticula plus diverticulate broom cell-like termini, all in an "epicutis of pileus with a distinct *Ramealis*-structure" (Singer 1955).

If eventually found to belong in *Mycetinis*, *Ma. alliodorus* would join the group of species with diminutive basidiomata, *My. yunnanensis*, *My. olidus*, *My. cinnamomeus*, etc.

Bullach's (2003) report of *Ma. alliodorus* from eastern Russia is doubtful, equally so with reference to *My. yunnanensis*, known only from the other end of China. Another species of *Mycetinis* is to be expected.

Based on Singer's protologue, illustration and reference (Singer 1969: 73) there is a slight possibility that *M. aporpocephyses* Singer could also be a *Mycetinis*. If so, it would be the only clampless taxon in the genus.

### Excluded species

***Mycetinis epidryas* (Kühner) Antonín & Noordeloos. 2008. Czech Mycol. 60: 26.**

**Basionym:** *Marasmius epidryas* Kühner ex A. Ronikier 2009. Mycol. Progr. 8: 381 [*Marasmius epidryas* Kühner "1935" (1936). Ann. Soc. Linn. Lyon 79: 17, nom. inval.].  
 ≡ *Rhzomarasmius epidryas* (Kühner) M. Ronikier & A. Ronikier. 2011. Mycologia 103: 1124–1132.

**Notes.** *Marasmius epidryas* is excluded from *Mycetinis* taxonomically by its phylogenetic placement in the Physalacriaceae. Ronkier and Ronkier (2011) showed a close relationship of *M. epidryas* to *Rhizomarasmius pyrrhocephalus*. Morphologically, microstructures had been accepted as similar to members of *Mycetinis* (Antonín & Noordeloos, 2008).

Nomenclaturally, Kühner's protologue did not include a Latin diagnosis, mandated shortly before the appearance of his publication. Ronkier (2009) explicitly validated *M. epidryas*.

Selection of a type specimen is also problematic. Antonín and Noordeloos (1993) considered that no type had been explicitly declared by Kühner "1935" (1936). Instead, they designated a neotype, "France, Haute-Savoie, Pralognan, 26.VIII.1968, R. Kühner (G)." As part of validation of the basionym, however, Ronkier (2009) designated a specimen with data agreeing with Kühner's original text ("En troupes denses sur les rochers, dans les trouffes de *Dryas octopetala*, au début de septembre, dans la région de Bozel, près de Moutiers-Salins (Savoie)." Ronkier's designation, however, was termed a holotype, a specimen which could only have been designated by Kühner, himself. Instead, Ronkier's selection must be considered a lectotype, this error being correctable under nomenclature rules.

Redhead et al. (1982) summarized literature on distribution of the species.

## Discussion

Earle's (1909) genus name, *Mycetinis*, was overlooked for decades. As molecular sequence analyses were introduced as a taxonomic tool, Earle's generic type, *Marasmius alliaceus*, was found to form a discrete clade, later found to include *M. scorodonius* and the enigmatic *Marasmiellus opacus*. Owings and Desjardin (1997) were the first to put a name to the clade. By now, several studies have confirmed and enlarged the clade, which takes its place within the large assemblage, *Gymnopus*, now understood to be para- or polyphyletic (see Fig. 1). *Mycetinis*, it would seem, is ready for a monographic treatment.

These days, it is common to rely on nucleotide databases (i.e. GenBank, Unite, etc.) to provide molecular matches to unidentified collections and therefore a name for an organism. But the state of the discipline (molecular taxonomy) has not reached a point in which most names are represented by pertinent DNA sequences. Until that time comes, identification will continue to include morphological characters through keys, descriptions and illustrations. The current study will not improve this situation, where seven of the included 15 taxa are presently without known DNA sequences. Instead, pileipellis structure and pervasive odor of garlic seem to diagnose this taxonomic entity but for those taxa that could be included in molecular analyses, *Mycetinis* is monophyletic with respect to the closest *Gymnopus* outgroup. The situation will improve, but as obscure taxa are discovered, whether fresh or dried, sequences for all taxa

will remain elusive. Meanwhile, candidates for inclusion in *Mycetinis* will be found in *Marasmiellus*, *Marasmius* and even *Gymnopus* (= traditional *Collybia*).

As summarized under Taxonomic Characters, *Mycetinis* taxa seem to sort by basidiomatal size/stature. The smallest resemble small thumb tacks or *Marasmiellus* basidiomata. Those of intermediate size resemble the numerous members of *Gymnopus* sect. *Androsacei* and sect. *Perforantia*, and those of gracile moderate size could be mistaken for small examples of *Gymnopus* sect. *Vestipedes*.

Figure 1 represents an overview of *Gymnopus* and related clades/genera. Within the ingroup, two major clades can be identified. One major clade includes numerous *Gymnopus* taxa, including the typus generis, *G. fusipes*. A significant element of this major clade is inclusion of Sect. *Androsacei* (formerly found in *Marasmius*; see Mata et al. (2007) and Sect. *Perforantia* (formerly found in *Micromphale*; see Petersen & Hughes, (2016).

The second major clade (Fig. 1) includes numerous *Gymnopus* taxa, but also several additional clades now treated as genera: *Connopus*, *Rhodocollybia*, *Lentinula* and *Marasmius pallidocephalus* – probably a monotypic genus. The small clade of *Mycetinis* is allied with a small clade of Antipodal collections (to be treated in a subsequent paper). In fact, the current study is an ancillary effort to understand *Mycetinis* so as to better treat the small sister clade. To this cluster of genera can be added the recently published *Gymnopenella* (Sandoval-Leiva et al. 2016).

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## Appendix I

### The argument for retention of *Agaricus prasiosmus* in *Mycetinis*

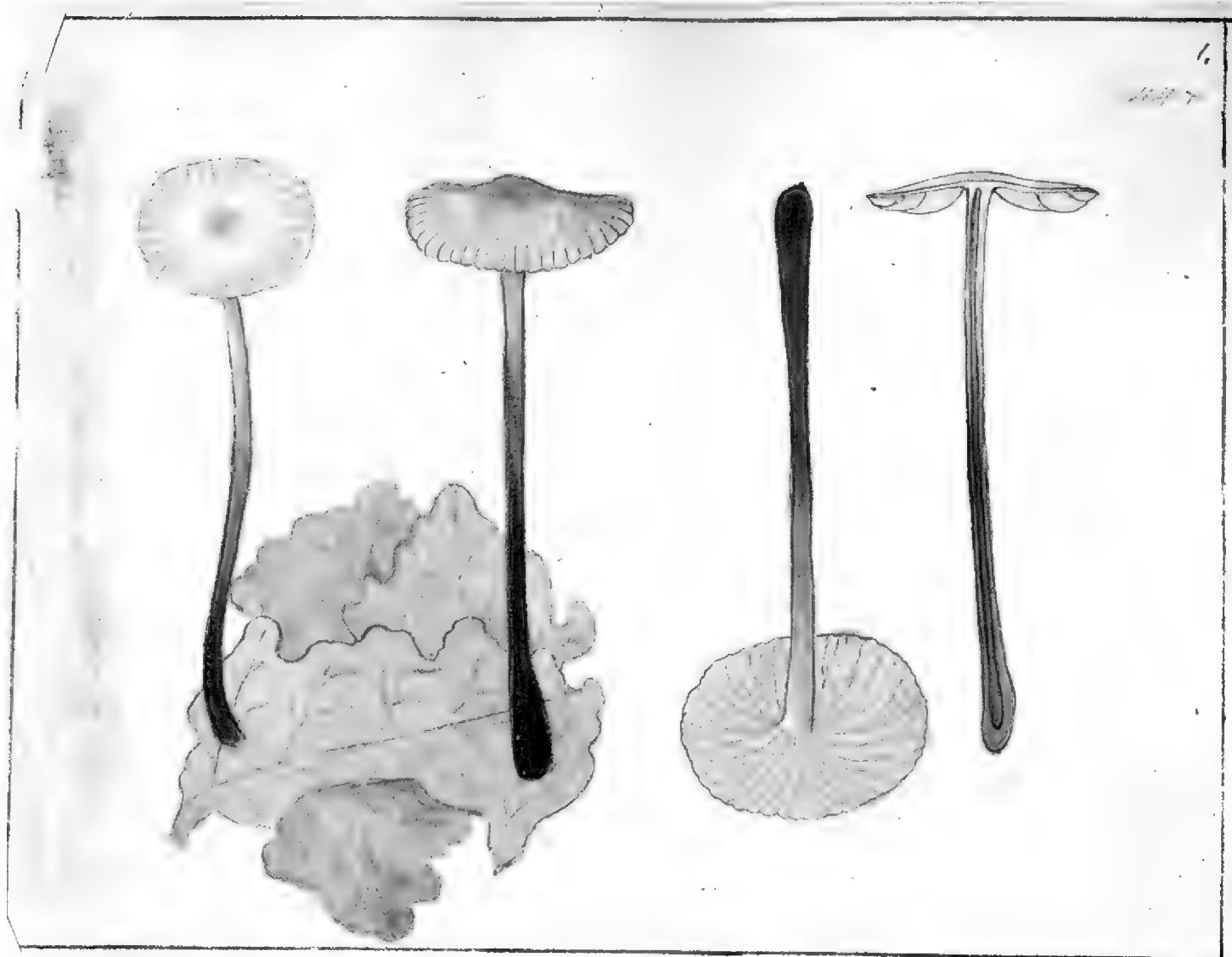
Persoon (1799) perceived differences among various concepts of *Agaricus alliaceus*. Namely, Jacquin, Schaeffer, Scopoli and Sowerby had all used the binomial, but differences in descriptions and illustrations caused Persoon to utilize three binomials: *A. alliaceus* sensu Jacquin, *A. schaefferii* Pers. (*A. alliaceus* sensu Schaeffer) and *A. scopolii* Pers. (*A. alliaceus* sensu Scopoli and Sowerby). By 1801, Persoon (1801) proposed his own name, *A. porreus*, for Scopoli's and Sowerby's fungus. Persoon's (1801) description of *A. porreus* reads almost word-for-word as that of *A. scopolii* (Persoon 1799). Attribution of this concept to Scopoli and Sowerby produced the rather remarkable distribution: "in Carniola et circa Londinum."

While the original taxonomic cluster was segregated from *A. alliaceus*, and therefore with an assumed basidiome odor of garlic, nowhere in the descriptions of the segregates was this character expressed. Conversely, the stipe base in *A. porreus* was described as "deorsum sanguineo" and lamellae were described as "flavescensibus," characters which caused confusion for subsequent mycologists. Simultaneously, in Schumacher's brief writing accompanying an unpublished illustration, (scan courtesy of Henning Knudsen, C) (Figure 92, Schumacher's notation of *Agaricus porreus* Pers. is crossed out, replaced with "*A. allicinus* m:" Bulliard's tab. 524, figure 1. was also cited. The date of Schumacher's substitution is not known, but his unpublished plate (Fig. 93, scan courtesy of Henning Knudsen, C) was cited (Schumacher 1803: 270) in the description of his *A. allicinus*. Thus the name *Agaricus porreus* attributed to Persoon is what Schumacher wanted to depict, but he later changed his mind and did not publish the illustration. Parenthetically, Schumacher also penned "In foliis dejectis quercinis. Novembre."

1. *Agaricus porreus* Pers. pag. 376. Bull. Tab. 524. f. 1.  
allicinus m.

In foliis dejectis praevenus. Novemvir.

**Figure 92.**



**Figure 93.** Schumacher's unpublished illustration of *Agaricus allicinus*.

In his early comprehensive publication Fries (1818) accepted both *A. porreus* (p. 152) and *A. prasiosmus* (p. 153) as distinct but placed both in Tribus *Mycena*. Under the latter, Fries cited available names from Persoon and Schumacher for a species whose basidiomata he had not personally seen, but of which an “excellent illustration” by Schumacher had been examined (probably on Fries’s previous trip to Copenhagen). Rather than using the name employed by Schumacher (1803; *A. allicinus*), Schumacher’s unpublished illustration was cited as part of Fries’s introduction of his own epithet, *A. prasiosmus*. *Agaricus prasiosmus* Fries, therefore, seems to be based on Schumacher’s

concept of *A. porreus*/*A. allicinus*, represented by Schumacher's (1803) description and (unpublished) plate. Fries (1818) noted "Inter foliis dejecta faginea."

Fries's (1821) *Systema Mycologicum* was not, at that time, any more significant than other publications, but by later legislation, names adopted by Fries in *Systema* are to be considered as sanctioned and protected against previous synonyms. Fries's taxonomy, however, has not been subjected to the same standard as his nomenclature, although the principle of typification links the two.

In *Systema Mycologicum I* (Fries 1821), *Agaricus porreus* was placed in *Agaricus* Tribus *Clitocybe* Subtribus *Scortei*. Schumacher's *A. allicinus* was considered a synonym. Huhtinen (1985) considered this epithet in comparison to his *Marasmius kallioneus*, but according to Antonín and Noordeloos (1996), *A. porreus* has been considered to represent a *Gymnopus*, and in the face of taxonomic confusion they proposed *G. herinkii* to provide a name and type specimen for stability.

Fries (1821: 148) adopted *A. prasiomus*, again listing names he considered as synonyms. Its taxonomic placement was in *Agaricus* Tribus *Mycena* † *Genuinae*. Fries essentially repeated his 1818 description, this time adding in synonymy "*A. porreus* Pers. ad part." Fries (1821) explicitly added "(v. ic.)" presumably referring again to Schumacher's unpublished plate. But again, Fries (1821) used his own previously introduced binomial, *A. prasiomus*, to represent the taxon and this basionym must be considered as sanctioned.

Later, Fries (1836-1838), while executing a transfer as *Marasmius prasiomus*, but by now confronted with other fungi with similar characters, took pains to separate them from his *M. prasiomus*. Schumacher's (1803) *A. allicinus* was "adult," *A. porreus* ss. Schumacher was "smaller," etc. This time, however, for *M. porreus*, Fries cited plate 2020, fig. 2 of *Flora Danica* (Figure 94 which clearly shows basidiomata arising from leaves of *Quercus*, acknowledged by Fries as "Ad folia in quercitis.") The latter may indicate some doubt as to the very leaves on which basidiomata are found – only as leaves in forest with *Quercus*. But although Fries's 1836-1838 commentary is taxonomic (not nomenclatural), his statement: "Valde similes sunt, at tantum in Smolandia *M. porreum* legi; *prasiomum* in Scania, etc." summarizes his conclusion that there was little difference between the two other than geography.

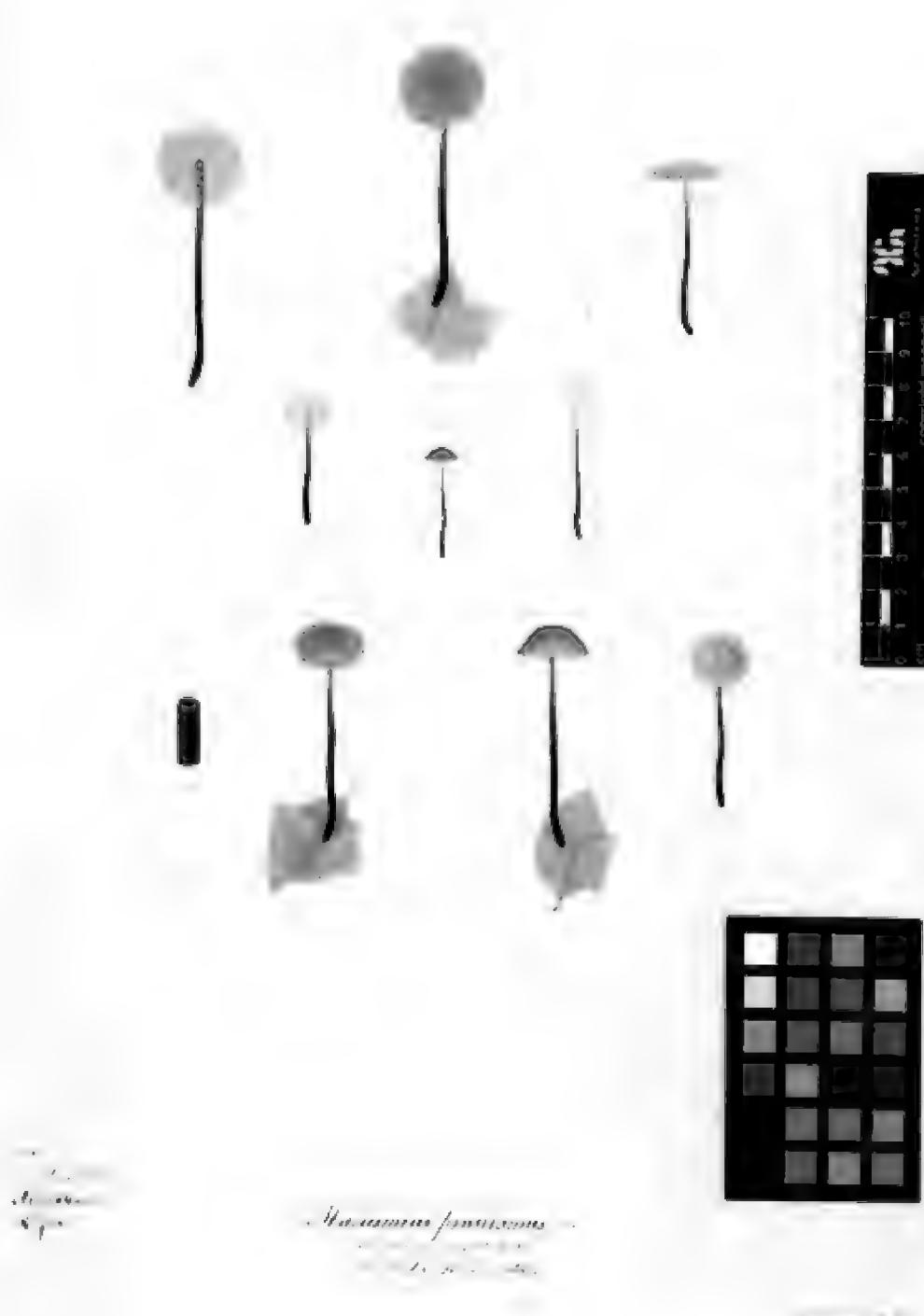
If *Flora Danica* plate 2020 figure 2(1830) is compared to the "unpublished" Schumacher plate (see above) the former seems surely based on the latter. Only one basidiome is missing in Pl. 2020.

Fries (1838) also referred to Secretan (1833) no. 831 ("excl. syn."). Secretan described two forms of *M. alliaceus*, neither named. Form A (presumably the typical form for Secretan) included references to Fries [1815] Obs. Mycol. 1: 30 and [1821] Syst. Mycol. 1: 140. Form B referenced Fries's (Fries 1815) Obs. Mycol. 1: 153 [as 152] and [1821] Syst. Mycol. 1: 148, and thus coincided with Fries's (1838) *M. prasiomus*. Under Form B, Secretan also included *A. allicinus* Schum. Saell. p 270. and *A. porreus* ("excl. nonnullus synon.").

In summary this far: Although Fries had several names from which to choose, he introduced his own binomial, *Agaricus prasiomus* (Fries, 1818). This binomial, no-



**Figure 94.** Plate 2020 from *Flora Danica*.



**Figure 95.** Aquarelle of *A. prasiosmus* commissioned by E.M. Froies (Courtesy S).

menclaturally dating from Fries 1821, is protected against earlier names by later botanical legislation (ICNAPF, Art. X).

As recombined in *Marasmius* (Fries, 1836–1838), *M. prasiosmus* is used to this day at least in Scandinavia if not more widely. For subsequent workers, however, Fries's descriptions were discordant – it was difficult to assign his species epithet to a particular, narrowly defined taxon. Especially worrisome was his early habitat note on leaves of *Fagus*, but later expanding to include leaves of *Quercus*.

Fries (1857: Monographia Hymenomycetum Sueciciae, p. 219) again took up *Agaricus prasiosmus* under his summary of Swedish *Marasmius*. Enigmatically, while all other *Marasmius* entries were abbreviated as “M.”, *prasiosmus* retained its original “A.” Nonetheless, Fries cited his description in Epicrisis (1838) but also wrote: “Icon: Nostra in Mus. Ac. Sc. Holm.” This aquarelle, which is filed in the herbarium at Museum of Natural History, Stockholm as S0791 (Figure 95), notes (in handwritten script)

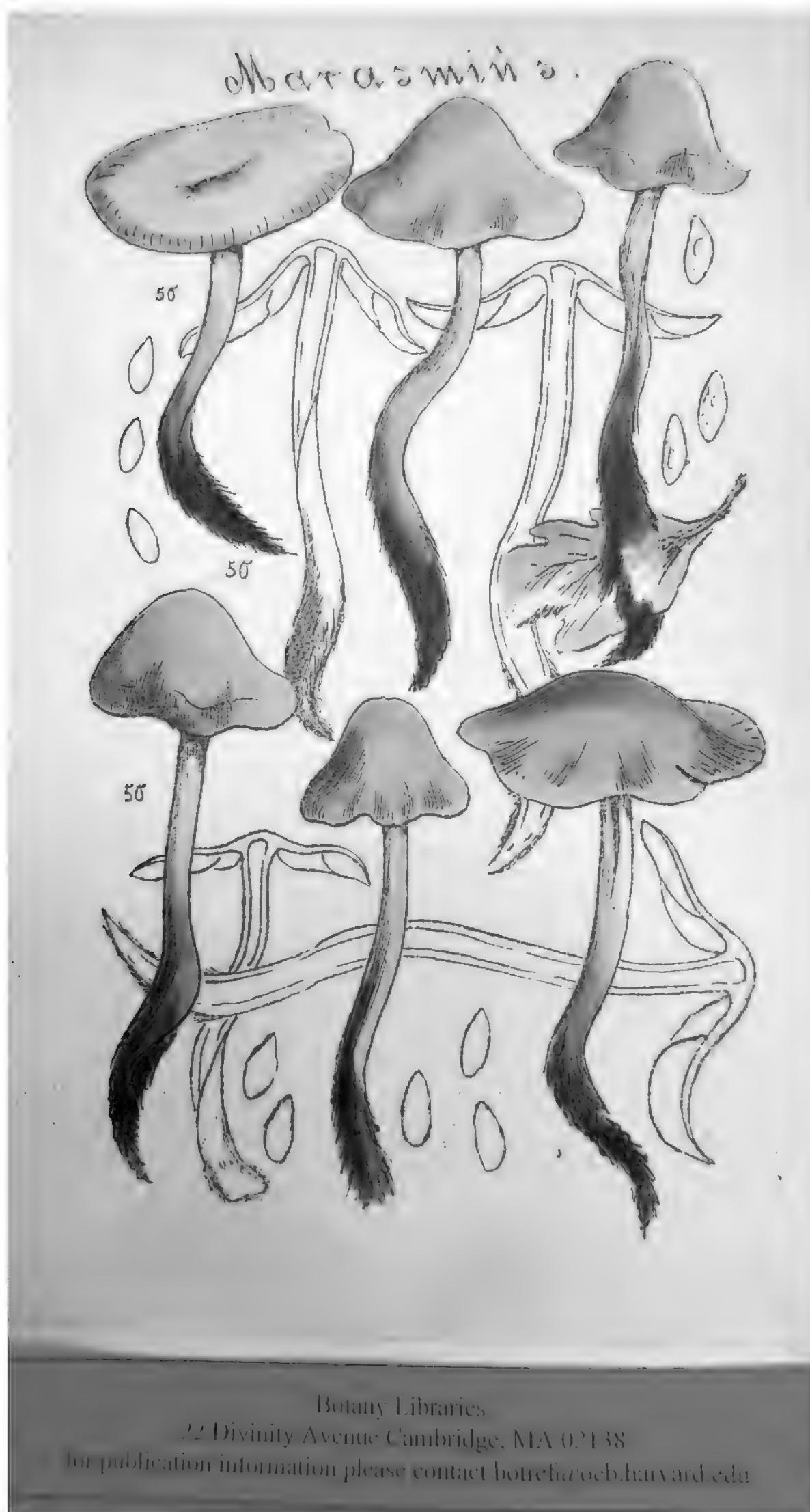


**Figure 96.** Enlargement from aquarelle in Figure 4.

that it was apparently executed by artist P. Åkerlund, signed by M.A. Lindblad and approved by E. Fries. Also written script notes Femsjö in 1855, a year when Lindblad visited Fries's hometown. Huhtinen (1985) studied and reported on this plate. An enlargement of selected basidiomata (Figure 96, clearly show the substratum as dead deciduous leaves, distinctly not *Quercus*, but not eliminating *Fagus* or *Betula*. When this relatively primitive plate is compared to Schumacher's unpublished illustration, macromorphological similarities are obvious.

#### Britzelmayr and *Marasmius querceus*

Citing his inability to accurately circumscribe *M. prasiosmus*, Britzelmayr (1896) introduced his *Marasmius querceus*. In his description, spore shape was paramount, with that of *M. prasiosmus* as (transl.) "elongate-rounded but only pointed at one end," with those of *M. querceus* (transl.) "10-12 × 4-6 µm, usually pear-shaped at both ends." Prominently, Britzelmayr referred to his tab. 542, figure 50. (Figure 97). This full-page illustration shows six basidiomata in color, five additional basidiomata outlined in section, and several spores. All basidiomata are robust with stipe agreeing with the



**Figure 97.** Britzelmayr's plate 50.

description of “3-6 mm thick.” Although a single basidiome is shown apparently connected to a leaf (probably *Quercus*), all examples show stipes as more or less equal to the lower half, then tapered gradually to an acute base (or short pseudorhiza as found in *Gymnopus fusipes*), and there dark brown and roughened, perhaps hirsute. Only one basidioma is shown (in outline) with a blunt stipe base perhaps suggestive of insititious insertion. A single basidioma is shown as applanate, perhaps with central depression. All others (nine) are shown as campanulate to conical. Of 11 spores shown, only one is shown to have a single guttule; all others are without differentiated contents. A second illustration cited by Britzelmayr (his Figure 35). Figure 98 shows a small group of basidiomata on a single *Quercus* leaf, attached by dissipating, curved stipes, white distally, dark brown proximally. The basidiomata are gracile, with slender stipes and compare well to the habit illustration of *M. querceus* by Antonín and Noordeloos (2010). The four spores are all depicted as having more than one inclusion.

If Britzelmayr’s figure 50 is compared with specimens from BRNM (Antonin’s collections) under the name *Marasmius querceus*, they seem to represent two separate organisms. In fact, the BRNM specimens seem to agree better with Britzelmayr’s figure 35 than to his figure 50. Britzelmayr also drew attention to illustrations he considered representative of his fungus: Bulliard (1792; Pl. 524, fig.1) and Cooke (1881-1883; vol. 7, Pl. 1120).

### Lange’s treatment

Representative of the Danish concept, Lange (1921, 1935) published on *Marasmius* at least twice, and in both cases included a key to Danish species, including *M. prasiosmus*, *M. allicinus* and *M. porreus*. In the first publication (Lange 1921), *M. prasiosmus* is placed in  $\beta$  *Cartilaginea* (Stem cartilaginous or almost horny, distally fistulose, polished or velvety-pruinose, generally becoming bay-brown or sepia from base upward), subdivided and with or without smell. Within “Stem powdery or velvety,” *M. prasiosmus* (“Stem without root, attached to dead foliage, base bay- brown, velvety”) was separated from *M. alliaceus* (“Stem rooting, blackish or fuscous, velvety-pruinose”).

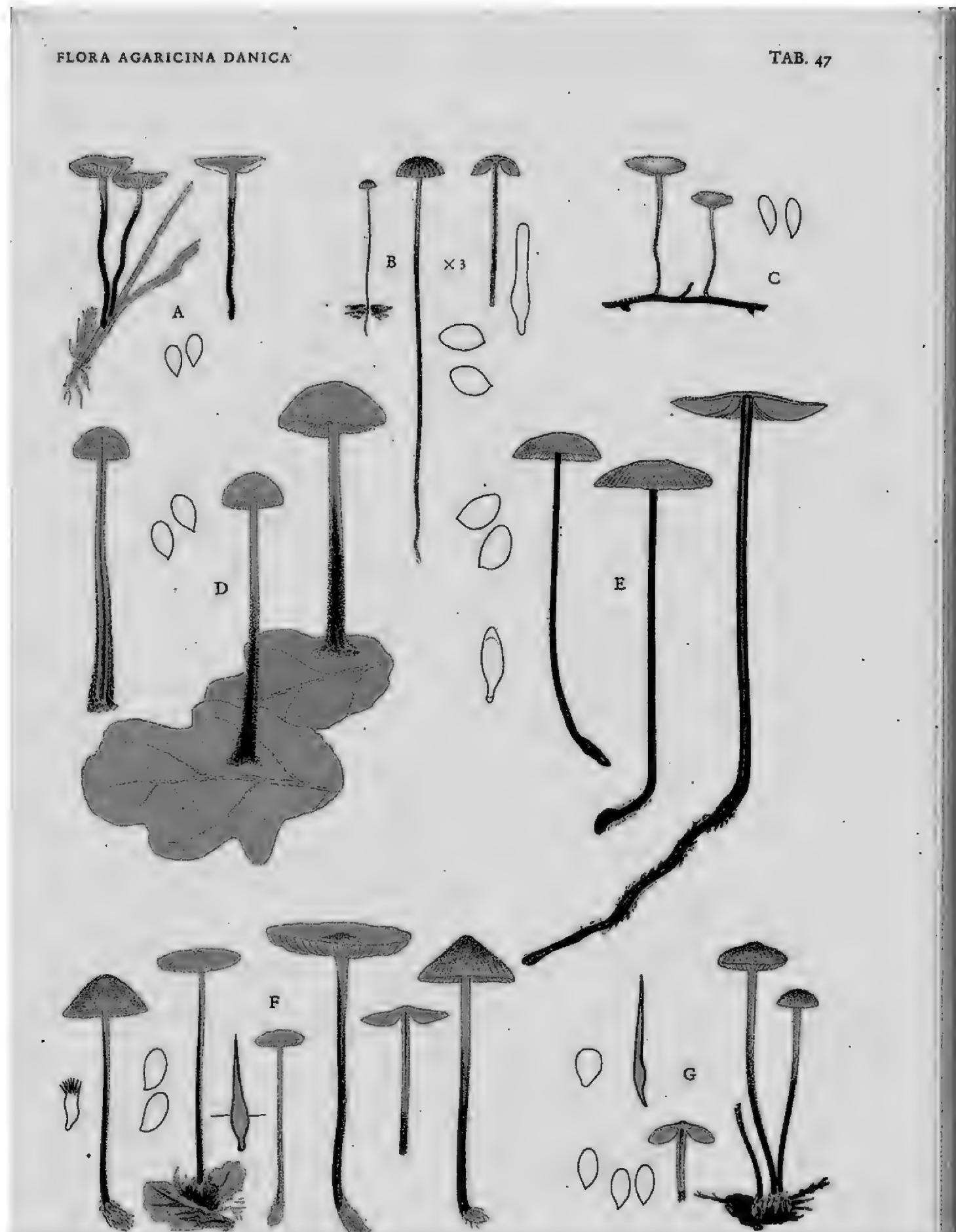
Moreover, Lange (1921: 19) took up *M. porreus* versus *M. prasiosmus*, previously addressed by Fries. Lange wrote: “My plant is almost intermediate between the descriptions of *M. prasiosmus* and *M. porreus* (Pers.). On account of the persistent smell, the rather crowded and thin gills, etc., I refer it to *M. prasiosmus*.” Thus, while not proposing synonymy, Lange saw the two names as representing very similar organisms.

Lange (1921) rejected spore dimensions of *M. prasiosmus* by some other workers, namely Massee (sp. 14–15 × 7  $\mu$ ), Ricken (sp. 7 × 4  $\mu$ ), and Bataille (sp. 8–11 × 4–5  $\mu$ ). Lange’s (1921) report on his own specimen was spores “9 × 5  $\mu$  pip-shaped (another find 8 × 4½–5  $\mu$ ). ”

Lange’s (1935) second major reference to *Marasmius prasiosmus* essentially repeated his earlier writing, but now cited “The base is truncate and attached to dead foliage (chiefly oak leaves).... Rather rare, in woods of *Quercus* (and *Fagus*).” By this latter



**Figure 98.** Britzelmayr's plate 35.



**Figure 99.** Lange's plate, including *M. prasiosmus*.

equivocation, Lange subsumed Fries's (1818) original reference to habitat on leaves of "faginea." Equally important was Lange's (1935, Plate 47, Fig D) (Figure 99). There, basidiomata of *M. prasiosmus* were shown as non-institititious, with pruinose stipe expanding downward, convex cap and attachment to *Quercus* leaves.

## Kauffman and smith

In the United States, Kauffman (1918. Agaricaceae of Michigan 1: 68.) took up Fries's binomial *Marasmius prasiosmus*, citing Fries's (1838) description and commentary in *Epicrisis*. From Kauffman's written description, macromorphological characters generally agree with Fries's written treatment, but when Kauffman specimens are examined, basidiomata are, perhaps, only  $\frac{1}{4}$  the size of the Swedish concept. Odor of garlic agrees, though, as does habitat on fallen leaves of *Quercus*. [Kauffman's concept may be seen in MICH-F-00051241, collected and determined by Kauffman as *M. prasiosmus*] Kauffman's report of spore characters ("Spores narrowly lanceolate, curved, acuminate at one end,  $12-15 \times 3-4 \mu\text{m}$ , smooth, white.") differs distinctly from specimens of *M. prasiosmus* from Fries's collecting grounds. Kauffman compared spore measurements from his collections to those reported by Cooke (1881–1883; spore width  $8 \mu\text{m}$ ) and Ricken (1915; spores  $7 \times 4 \mu\text{m}$ ) and referred to illustrations by both workers. In both cases, illustrations conform to the European concept of *M. prasiosmus*, with significantly larger basidiomata than envisioned by Kauffman.

Kauffman's species concept was passed on to Alexander Smith, who maintained it, including the smaller basidiomata and discrepant spores from the European concept. Three characters agreed with Kauffman's opinion: 1) odor of garlic; 2) habitat on oak leaves; and 3) long, slender, tapered spores. On handwritten labels for Smith specimens is found "*Marasmius prasiosmus*" or, occasionally, "*Marasmius prasiosmus* sensu Kauffman."

With two pertinent citations (Britzelmayr 1896; Kauffman 1918) of an illustration by Cooke (1881-1883, Illustrations 7, pl. 1120), Cooke's concept of *M. prasiosmus* may be investigated. In text (Cooke vol. 7: 7), *M. prasiosmus* is located in (inferred) Tribe 1, *Collybia* (not genus *Collybia*), infragenus *Tergini* ("Stem rooting, definitely tubular, not fibrous, manifestly cartilaginous. Gills receding, free. Pileus thinner than in the preceding [infragenus *Scortei*], hygrophanous, smooth, or striate at the margin."), finally "Stem woolly below, smooth above." Cooke's plate (Figure 100, shows a stipe white above, reddish brown downward, and attachment to deciduous leaf fragments but with bits of conifer needles or moss clinging to stipes. This illustration compares favorably to Britzelmayr's Figure 35.

Kauffman (1918) also referred to Ricken (1915), who, unlike Kauffman (1918), cited "*M. prasiosmus* (Fr. 1818)." Ricken's figure (Pl. 24, 4 (Figure 101), is only one basidiome, clearly with pseudorhiza. Stipe is paler upward, but distinctly darker downward, perhaps scurfy with possible scabers brown-black. If anything, Ricken's illustration might be compared to Britzelmayr's fig. 50, not his fig. 35.

Gilliam (1975b) recognized differences between American and European concepts of *M. prasiosmus*, and proposed *M. olidus* for Kauffman's organism. In the current study, Gilliam's epithet has been recognized as belonging in *Mycetinis*. Desjardin (an-not. specimens from MICH, and Wilson and Desjardin 2005) found that Gilliam's *M. olidus* was microscopically indistinguishable from *M. copelandii* from the North American west coast. This led to the combination, *Marasmius copelandii* var. *olidus*.



**Figure 100.** Cooke's plate of *M. prasiosmus*.



**Figure 101.** Ricken's plate including *M. prasiósmus*.

## Antonín and Noordeloos

The same taxonomic problem that Britzelmayr identified has been discussed repeatedly by Antonín and Noordeloos (1993, 1996, 1997, 2010). What fungus truly represents Fries's *Agaricus (Marasmius) prasiosmus*, when Fries (1818/1821 versus 1838), himself, seemed taxonomically inconsistent? Their solution (Antonín and Noordeloos 1996) has been to dismiss Fries's name altogether (as a *nomen confusum*), and to accept Britzelmayr's *Marasmius querceus* based on two principles: a) Britzelmayr's name is supported by a colored plate (iconotype, Figure 50, which secures this name, although no type specimen was (or has been) designated; and b) Fries's concept is "confused" (taxonomy, not nomenclature) and therefore not secure. Antonín (pers. comm. 2016), however, agrees that Britzelmayr's Figure 50 is inappropriate to represent *M. querceus*, but that Figure 35 might be better. In the absence of a type specimen, designation of a substitute iconotype would be a difficult nomenclatural task. Antonín and Noordeloos (under *M. querceus*; 2010; figs 118, 119) habit photos can be favorably compared to historical illustrations of *Marasmius prasiosmus* furnished above.

Specimens identified as *M. querceus* Britzelmayr, cited by and borrowed from Antonín during the present study, do not resemble Britzelmayr's aquarelle (Figure 50, but are morphologically similar to specimens of *M. prasiosmus* from Sweden (see specimens examined under *M. prasiosmus*), and certainly macromorphologically very similar to Schumacher's unpublished plate and to Flora Danica 2020 (for Fries as *A. prasiosmus*).

Finally, DNA sequences (nrITS) from specimens from UPS match a sequence from an Antonín specimen, indicating that they are conspecific. Moreover, three sequences from Estonian specimens also match. Surely a single species-rank taxon is distributed from Scandinavia to central continental Europe. Conversely, Britzelmayr's name remains without a type specimen and a discordant illustration as representatives.

Under the ICNAP (International Code of Nomenclature), however, three solutions to this situation are circumstantially outlined. First, Fries's name can be proposed for rejection, leaving free the opportunity to "replace" it with Britzelmayr's *M. querceus*. Second, Britzelmayr's *M. querceus* may be proposed as conserved over Fries's name. Third, Fries's name may be typified, thus creating a taxonomic entity on which to anchor Fries's name (with due regard for taxonomic and geographic accuracy). The resultant typified name would claim priority over Britzelmayr's name (if it is considered synonymous) and resurrect a Friesian name for the organism.

Antonín and Noordeloos (1993) adopted Britzelmayr's *Marasmius quercus*, but Fries's name is only confusing until it is appropriately typified by a specimen, at which point it becomes secure, both taxonomically and nomenclaturally. As referenced in the main manuscript, I prefer this option. Britzelmayr's *M. querceus* is left for future neotypification with a specimen.

## Appendix 2

List of collections used for Figures 2 and 77 and GenBank numbers

Sequence ID	Organism	Specimen Voucher	Isolate	Collection Location <sup>1</sup>
KY696725	<i>Mycetinis scorodonius</i>	TENN-F-50343	TFB4746	Switzerland <sup>2,3</sup>
KY696726	<i>Mycetinis scorodonius</i>	TENN-F-50352	TFB 4755	Switzerland <sup>2,3</sup>
KY696727	<i>Mycetinis scorodonius</i>	TENN-F-50369	TFB 4772	Switzerland <sup>2,3</sup>
KY696728	<i>Mycetinis scorodonius</i>	TENN-F-50377	TFB 4780	Switzerland <sup>2,3</sup>
KY696729	<i>Mycetinis scorodonius</i>	TENN-F-50447	TFB 4372	Mexico, Tabasco <sup>2,3</sup>
KY696730	<i>Mycetinis scorodonius</i>	TENN-F-50515	TFB 3778	Sweden <sup>2,3</sup>
KY696731	<i>Mycetinis scorodonius</i>	TENN-F-50522	TFB 3785	Sweden <sup>2,3</sup>
KY696732	<i>Mycetinis scorodonius</i>	TENN-F-50533	TFB 3796	Sweden <sup>2,3</sup>
KY696733	<i>Mycetinis scorodonius</i>	TENN-F-50689	TFB 3701	USA, North Carolina <sup>2,3</sup>
KY696734	<i>Mycetinis scorodonius</i>	TENN-F-50696	TFB 3708	USA: Tennessee, GSMNP <sup>2,3</sup>
KY696735	<i>Mycetinis scorodonius</i>	TENN-F-50763	TFB 3644	USA: Tennessee, GSMNP <sup>2,3</sup>
KY696736	<i>Mycetinis scorodonius</i>	TENN-F-50809	TFB 3690h1	USA: Tennessee, GSMNP <sup>2</sup>
KY696737	<i>Mycetinis scorodonius</i>	TENN-F-50809	TFB 3690h2	USA: Tennessee, GSMNP <sup>2</sup>
KY696738	<i>Mycetinis scorodonius</i>	TENN-F-51233	TFB 4915	USA, North Carolina <sup>2,3</sup>
KY696739	<i>Mycetinis scorodonius</i>	TENN-F-51442	TFB 5031	Canada, Nova Scotia <sup>2,3</sup>
KY696740	<i>Mycetinis scorodonius</i>	TENN-F-53465	TFB 5014	Canada, Nova Scotia <sup>2,3</sup>
KY696741	<i>Mycetinis scorodonius</i>	TENN-F-53466	TFB 4969	USA, New York <sup>2,3</sup>
KY696742	<i>Mycetinis scorodonius</i>	TENN-F-53467	TFB 5025	Canada, Nova Scotia <sup>2,3</sup>
KY696743	<i>Mycetinis scorodonius</i>	TENN-F-53468	TFB 5038	Canada, Nova Scotia <sup>2,3</sup>
KY696744	<i>Mycetinis scorodonius</i>	TENN-F-53469	TFB 4989	USA, Maine <sup>2,3</sup>
KY696745	<i>Mycetinis scorodonius</i>	TENN-F-53470	TFB 5046	USA, North Carolina <sup>2,3</sup>
KY696746	<i>Mycetinis scorodonius</i>	TENN-F-53471	TFB 4939	USA, New York <sup>2,3</sup>
KY696747	<i>Mycetinis scorodonius</i>	TENN-F-53472	TFB 5067	USA, North Carolina <sup>2,3</sup>
KY696748	<i>Mycetinis scorodonius</i>	TENN-F-53474	TFB 5005	USA, Maine <sup>2,3</sup>
KY696749	<i>Mycetinis scorodonius</i>	TENN-F-53568	TFB 7261	Sweden <sup>2,3</sup>
KY696753	<i>Mycetinis scorodonius</i>	TENN-F-57663	TFB 2782	USA: Georgia
KY696754	<i>Mycetinis scorodonius</i>	TENN-F-58260	TFB 10400	Russia, Leningrad Region <sup>2,3</sup>
KY696755	<i>Mycetinis opacus</i>	TENN-F-59451	TFB 11565h1	USA: Tennessee, GSMNP <sup>2</sup>
KY696756	<i>Mycetinis opacus</i>	TENN-F-59451	TFB 11565h2	USA: Tennessee, GSMNP <sup>2</sup>
KY696757	<i>Mycetinis scorodonius</i>	TENN-F-59615	TFB 11652	Russia, Novgorod <sup>2,3</sup>
KY696758	<i>Mycetinis opacus</i>	TENN-F-60016	TFB 11787	USA: Tennessee, GSMNP <sup>2</sup>
KY696759	<i>Mycetinis opacus</i>	TENN-F-60525	TFB 12451h1	USA: Tennessee, GSMNP <sup>2</sup>
KY696760	<i>Mycetinis opacus</i>	TENN-F-60525	TFB 12451h2	USA: Tennessee, GSMNP <sup>2</sup>
KY696761	<i>Mycetinis opacus</i>	TENN-F-60541	TFB 12467h1	USA: North Carolina, GSMNP <sup>2</sup>
KY696762	<i>Mycetinis opacus</i>	TENN-F-60541	TFB 12467h2	USA: North Carolina, GSMNP <sup>2</sup>
KY696763	<i>Mycetinis opacus</i>	TENN-F-61508	TFB 13246h1	USA: Tennessee, GSMNP <sup>2</sup>
KY696764	<i>Mycetinis opacus</i>	TENN-F-61508	TFB 13246h2	USA: Tennessee, GSMNP <sup>2</sup>
KY696765	<i>Mycetinis alliaceus</i>	TENN-F-67899	TFB14149	Germany: Thuringia <sup>2</sup>
KY696766	<i>Mycetinis alliaceus</i>	TENN-F-67911	TFB14161	Germany: Thuringia <sup>2</sup>
KY696768	<i>Mycetinis opacus</i>	TENN-F-69200	TFB14490h1	USA: Mississippi <sup>2</sup>
KY696769	<i>Mycetinis opacus</i>	TENN-F-69200	TFB14490h2	USA: Mississippi <sup>2</sup>
KY696767	<i>Mycetinis opacus</i>	TENN-F-69190	TFB14499	USA: Mississippi <sup>2</sup>

Sequence ID	Organism	Specimen Voucher	Isolate	Collection Location <sup>1</sup>
KY696770	<i>Mycetinis alliaceus</i>	TENN-F-69243	TFB14548	Slovakia <sup>2</sup>
KY696771	<i>Mycetinis alliaceus</i>	TENN-F-69244	TFB14549	Slovakia <sup>2</sup>
KY696772	<i>Gymnopus androsaceus</i>	TENN-F-69268	TFB 14571h2	Slovakia <sup>2</sup>
KY696773	<i>Mycetinis scorodonius</i>	ASM13017		Sweden <sup>2,3</sup>
KY696774	<i>Mycetinis quercus</i> ( <i>My. prasiosmus</i> )	BRNM666586	VA 01.340	Moravia <sup>2</sup>
KY696776	<i>Mycetinis opacus</i>	JLM1601h1		USA: Tennessee, GSMNP <sup>2</sup>
KY696777	<i>Mycetinis opacus</i>	JLM1601h2		USA: Tennessee, GSMNP <sup>2</sup>
KY696778	<i>Mycetinis curraniae</i>	PDD 95301	JAC10833	New Zealand <sup>2</sup>
KY696779	<i>Mycetinis curraniae</i>	PDD 95456	JAC11002	New Zealand <sup>2</sup>
KY696780	<i>Mycetinis curraniae</i>	PDD 95546	JAC11095	New Zealand <sup>2</sup>
KY696781	<i>Mycetinis curraniae</i>	PDD80999	JAC9224	New Zealand <sup>2</sup>
KY696782	<i>Mycetinis curraniae</i>	PDD86987	JAC9878	New Zealand <sup>2</sup>
KY696783	<i>Mycetinis curraniae</i>	PDD101751	PL4105	New Zealand <sup>2</sup>
KY696789	<i>Mycetinis salalis</i>	WTU-F-009308		USA, Washington <sup>2</sup>
KY696786	<i>Mycetinis scorodonius</i> f. <i>dimutivus</i>	WTU19061h1		USA, Washington <sup>2,3</sup>
KY696787	<i>Mycetinis scorodonius</i> f. <i>dimutivus</i>	WTU19061h2		USA, Washington <sup>2,3</sup>
KY696788	<i>Mycetinis scorodonius</i> f. <i>dimutivus</i>	WTU22200		USA, Washington <sup>2,3</sup>
KY696752	<i>Mycetinis alliaceus</i>	TENN-F-55630	TFB 8970	Russia: Caucasia <sup>2</sup>
KY696784	<i>Mycetinis prasiosmus</i>	UPS-F012968		Sweden <sup>2</sup>
KY696785	<i>Mycetinis prasiosmus</i>	UPS-F740422		Sweden <sup>2</sup>
KY696750	<i>Mycetinis copelandii</i>	TENN-F-55408	TFB 8084h1	USA: California <sup>2</sup>
KY696751	<i>Mycetinis copelandii</i>	TENN-F-55408	TFB 8084h2	USA: California <sup>2</sup>
KY696775	<i>Mycetinis applanatipes</i>	SFSU DED6628		USA: California <sup>2</sup>

<sup>1</sup> GSMNP=Great Smoky Mountains National Park <sup>2</sup> Figure 2; <sup>3</sup> Figure 77